

March 16, 1959

Aviation Week

Including Space Technology

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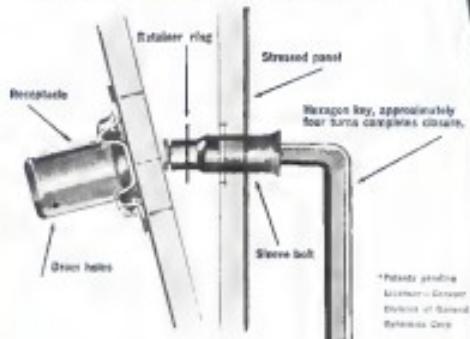
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AVIATION CALENDAR

March 29-30—Flight Testing Conference
American Rocket Society, Decherd Plaza Hotel, Decherd, Illinois, Ill.
March 15-16—National Convention, State of Radio Engineers, Commercial and Industrial Broadcasters, New York, N.Y.
March 25-27—14th Annual Conference, Pacific Coast Section of the Society of the Plastic Industry, Hotel del Coronado, San Diego, Calif.
March 26-27—National Assembly Meeting and Seminar of Automotive Engineers, Hotel Commodore, New York, N.Y.
April 3-4—Conference on Electronics, Electrical Works sponsored by the Thermal Radiation Laboratory of the Comprehensive Engineering Institute of the Air Force, Cambridge Research Center, Somerville, Mass., Fenton, Mass.
April 8-10—1958 Nuclear Congress, Municipal Auditorium, Cleveland, Ohio.
April 8-10—National Military Industrial Council, Inc., Annual Meeting, Washington, D.C.
April 8—Meeting, Post No. 541 G.A.R., American Merchant Naval Union, Wall Street, Astoria, New York, N.Y.
April 12-13—Annual Meeting, American Association of Airport Executives, Louisville.
April 12-14—Management Conference on Technical Measurements, Institute of Technology, Cambridge, Mass., Sponsored by the Office of Scientific Research and Development, National Science Foundation, Washington, D.C.
Contact: Dr. Ernest E. Pyle, National Bureau of Standards, Washington, D.C.
April 12-19—Air Fair, Las Vegas, Nev.
April 15-17—Second Annual Symposium on Solid-State and Device Physics, for the University of Illinois, Urbana, Ill.
April 16—Conference on Aviation Safety. [Continued on page 5]

AVIATION WEEK, including Space Technology

March 16, 1959

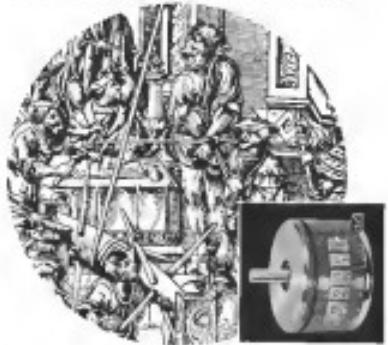
Vol. 76, No. 11

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AVIATION WEEK, March 16, 1959

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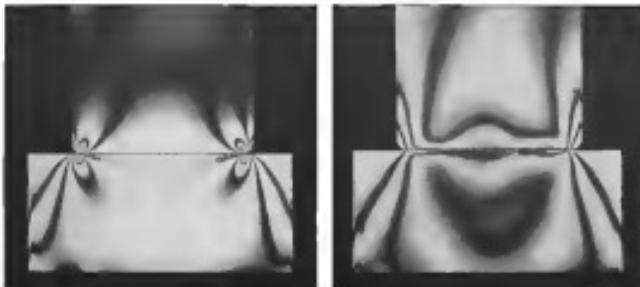
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ROLLER BEARING LIFE AND CAPACITY LINKED TO STRESS DISTRIBUTION



These reproductions of photostatic studies certain important evidence for improved roller bearing design. In addition to the performance and selection of roller bearings, these photographs, the stresses, shock and fatigue, called fatigue, indicate not only the magnitude of stress but also the stress distribution. The photographs were taken by Bower Research Engineers during a study of stress distribution in roller bearings.

The subjects represent rollers and raceways of two roller bearings under identical loads. The illustration on the left shows a roller of conventional design. The illustration at the right shows a Bower "Profiled" roller. As the roller is precision ground along the body of the roller—a profiled end and centralized distance from each end.

roller ends. This is called edge-loading. Such areas of concentrated stress are the breeding grounds for metal fatigue and eventual bearing failure.

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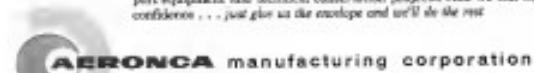
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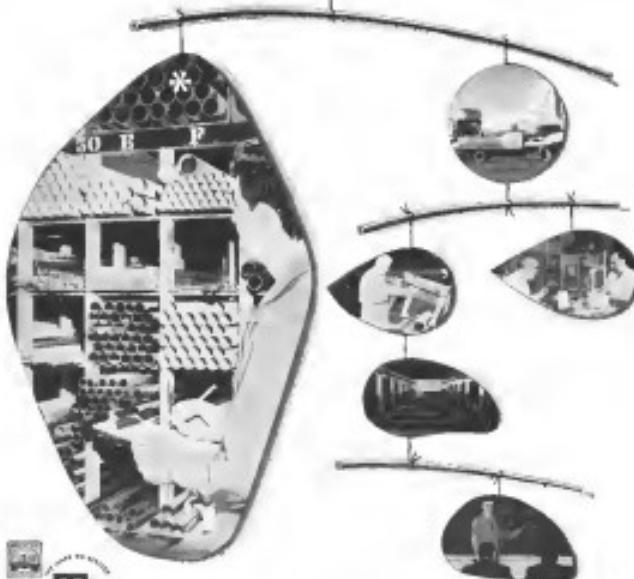
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EDITORIAL

Navy's Anti-Submarine Warfare Problem

The problem of developing an effective anti-submarine warfare capability against nuclear powered submarines is probably the Navy's top priority problem. For the future in addition to its anti-submarine capability, the nuclear powered submarine also offers a strategic threat when equipped for missile launching.

The Soviet Union is developing a strong submarine surface capability both in its peripheral waters and for long range transoceanic hunting operations. It now has an operational force of some 450 submarines of every short half dozen long-range interlocking types. This fleet is already larger than the most powerful submarine force Nazi Germany was able to launch at the peak of its terribly effective campaign against allied shipping in World War II. Soviet submarines have become extremely active, well within their international rights, in the Atlantic where U.S. Navy ASW forces have conducted and tracked them underwater, undoubtedly not long enough to force them to surface. The Soviets announced last December an extensive program of underwater nuclear explosion, including explosions of the North American Continental Shelf.

Increasing Soviet Capability

There also is evidence that the Soviets are developing nuclear-powered submarine capability. The three small nuclear reactors now being tested aboard the nuclear submarine Luray are of types designed for eventual use in subsurface, and submarine hulls designed for nuclear power are now under construction. Russia's Vice Adm. John S. Thach, commander of Task Force ALFA and one of the top U.S. Navy ASW experts, believes the secret backbone of the active Soviet submarine fleet strength from 400 last June to the present 450 is an indication that crews are being withdrawn from operational status for refueling at the techniques of nuclear submarines.

ASW is hard, dirty and inglorious work and has never been a favorite career among top Navy officers. Until recently, it has been just as difficult to sell the importance of ASW within the Navy as it has been to the Defense Department and the Congress. However, in recent years, thanks to the example of some dedicated ASW advocates, the Navy has developed a growing capability in this field within the technical and financial resources available to it. Development of relatively small and inexpensive nuclear depth charges has made the kill probability, once a submarine has been definitely located, close to 100%.

Bottling Obsolescence

However, the big deficiency in current ASW technique is better detection and communications between ships, coupled with longer and swifter search forces.

The Navy also has developed a sound weapon system except for ASW that utilizes every resource available. From other references through surface craft to airborne equipment. A good example of low coordination of

equipment can stretch the capability of oldstandby just a little further are the current experiments with down helicopters operated from destroyers to extend the latter's killing radius.

But all of the reusing of old ideas, even with some theory now refined policies, is only an interim, right shift solution to the Navy's real ASW problem of the future. What is really needed is some basic research and development breakthroughs all along the ASW line, with the possible exception of "kill" weapons where a long-term solution apparently is already in hand. The research and development effort must range all the way from basic exploration of the ocean floor and the world below the water's surface to new methods of communications via through air and water and communications through air below present capabilities and through new vehicles for submarine, surface and underwater search efforts.

While current ASW capability must be developed and stretched to its inherent limits, the real ASW problem now lies in the research and development area. Therefore, it is particularly depressing to note the shockingly small funds being allocated to the Navy's ASW Research and development effort is both the current Fiscal 1975 and the future Fiscal 1983 budget. This item is now considered, after a somewhat meager budget ceiling for Fiscal 1975 despite a \$45 million boost by Congress above Administration requests. Prospects are that ASW research and development will take a slight cut in the Fiscal 1983 defense budget now being debated on Capitol Hill. We strongly recommend that Congress take a long and detailed look at this particular item when it considers the Senate version of the present submitted budget as it is currently deficient.

Aid From Industry

In face of this official budgetary indifference, it is encouraging to note the response of the civilian industry and its related organizations to the Navy's plan for a broad attack on the research and development horizon of ASW. Within the past year, several major firms have created ASW research and development organizations within their own industrial structure to also aid a systems approach to this problem. Because of the powers of Navy funds for this work, many other firms are taking major and developmental positions on fiscal "dollar a year" Navy contracts. The active response of industry to the Navy's needs in this area has been in marked contrast to the relative indifference of the highest official levels.

We fervently hope that industry will continue this long-term commitment in the ASW problem and that the concern within the Navy who have been fighting so hard in this year's fiscal spotlight on this problem will not be beaten by top-level official criticism or indifference, and that the Congress will devote considerable attention to this important field of our overall defense structure.

—Robert Hays

THOMAS A.

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WHO'S WHERE

In the Front Office

Leroy S. Johnson and Paul E. Smith, divisional heads, the Divistar Co., Bedford, Conn. Mr. Johnson is vice president of Divistar and Mr. Smith is general manager of the company. Edward D. Deneen, Mr. Smith's predecessor, left the Co.'s business.

Richard K. Foster and A. F. Fostner, directors, South Aviation Corp., New York. Mr. Foster is vice president and general manager; Mr. Fostner, operations manager. Foster is reporting to his president, Mr. Fostner.

Kenneth A. Rissman, director, Amersonton Division at General Dynamics Corp., a director, Boston Haven, Ltd., Houston, Texas.

Walter H. Schwertfeger and Don L. Walker, division managers, McDonnell Aircraft Co., St. Louis.

Mr. Schwertfeger was president of the company.

Matthew J. Fornari, managing engineer and a director, Lockheed Corp., Burbank, Calif.

Mr. Fornari is a member of Space Technology Laboratories Inc.

Consolidated Phonomatic Corp. has announced that the Western Division is now Consolidated Phonomatic Corp. of America, Calif., operating as a subsidiary of CEC. Philip S. Pegg, CEC president and board chairman, and Kenneth W. Patrick, CEC vice president and board chairman and general manager, are the new company.

Henry E. Bell, Jr., has been named vice president and general manager of the new corporation. Other officers are: Franklin H. Braun, financial vice president; Walter H. Fullenkamp, secretary; William R. Frazee, treasurer and assistant treasurer; John J. McLean, director of engineering; and Leuben G. Geddes, director of research.

John T. Jenkins, vice president, International Telephone and Telegraph Corp., New York, N.Y.

R. W. Shadley, vice president-general operations, Rockford Airlines Inc., Rockford, Ill.

John J. Coughlin, vice president, Bellanca Research and Development Laboratories Inc., a subsidiary of Edson Works Co., Windham, N.Y.

W. Glenn Myers, corporate vice president, Lockheed Aircraft Corp., Fort Worth, Calif.

George S. Stern, staff vice president, Radiodine Inc., McMechan, Fla. Dr. Charles E. Barnes succeeds Mr. Stern as vice president.

Robert E. Ladd, vice president, Convair Aircraft Co., Wichita, Kan. Mr. Ladd comes to general manager of Convair's military aircraft division.

John S. Morell, vice president and general manager of operations, Franklin Products Inc. and American Plastics Corp., Dallas, Tex. Mr. Morell continues as a Texas vice president.

Col. Don F. Newton, executive vice commander and chief of plans and programs, Air Research and Development Command, Andrews AFB, Washington, D.C.

(Continued on page 109)

INDUSTRY OBSERVER

► Boeing has abandoned the solid propellant approach to a booster for its entry in the Divestar orbital booster competition and is reported to team with Convair. Boeing probably would use a modified Atlas plus the Convair F-100 or Whales (Convair 1060) 16,000 lb-thrust liquid hydrogen engine as the launching vehicle. Convair, originally planned as a 15,000 lb-thrust stage for Titan, now will be a two-booster, 30-35,000 lb-thrust stage for Atlas.

► Martin-Bell Dyna-Sat concept now calls for a three-booster Titan as the booster vehicle other than the cluster of three Titan plus high-energy second stage as originally planned.

► Army requested a total of \$115.5 million in its share of the Pluto test-potable antihaltite missile system, recently canceled by the Defense Department (AW Feb. 16, p. 12). Program began by Army as a defense against front-line troops, was taken over last year by the Advanced Research Projects Agency.

► McDonnell Aircraft Corp.'s two-stage test vehicle for its rechartered ballistic missile has eight fins rapidly spaced around the circumference of the body. Body itself is approximately 28 ft long. Four fins are spaced 90 deg apart on the first stage. Five more are spaced 90 deg apart on the second stage but offset from those on the first stage by 45 deg. Vehicle was recently ground-tested over the Atlantic Missile Range (SW Mar. 2, p. 29).

► ARGO D-1 long-range research sounding rocket using Honest John as a booster, and Nike Ajax motor as trailer and a hydrogen rocket developed by Navy Bureau of Ordnance and Allegany Ballistic Laboratory, will be fired within the next future by Aerobis Development Co., Pasadena, Calif., under military contract. Three vehicles are now being built, each will cover a 63-km period to a 1,000-m altitude.

► North American F-100 Super Sabre in service with Tactical Air Command will get a 200-lb inert load into a modification program now in progress at North American's Los Angeles Division. F-100 will be equipped with two 450-gal external tanks suitable for aerial refueling from either refueler TA-700 tank or other Super Sabres using the "buddy" system. Prior to this modification program, only the 1,155 gal capacity of the F-100 internal fuel tanks could be utilized by aerial refueling.

► Passive communications satellite to be launched next year by National Aerospace and Space Administration will be put into a 1,000-mi orbit, giving it a period of about 115 min. The 65-lb, 50-ft-diameter inflatable plastic sphere, coated with aluminum, will require ground equipment consisting of a high-gain antenna, low-noise receiver, large directional antenna and computing equipment.

► First flight for the Saturn I 5 million lb thrust cluster of Rocketdyne engines is now scheduled for September of next year. Booster is being developed by Army Ballistic Missile Agency. Preliminary captive test firing is hoped for before the end of this year.

► Army Merlin Pending selective range missile, the unfertilized replacement for Redstone, was allocated \$100.2 million for development during the next fiscal year. Program was initiated in late fiscal 1963 with an allocation of \$20 million.

► Navy will make a major, possibly last-ditch, effort to win approval of its proposal to purchase three British Pegasus flying boats for patrol aircraft to replace power during the forthcoming hearings on the U.S. ANF program by the Joint Congressional Committee on Atomic Energy. Proposed, originally voted by the Administration, against a total cost of approximately \$400 million, would have all three aircraft converted and flying as nuclear vehicles within five years.

LINDE'S NEW PLASMARC TORCH SERVICE

Brings Industry Production Parts From Refractory Metals

No other method of fabricating refractory metals can make this.... The high melting points of tungsten, tantalum, and molybdenum are no longer a problem. For Linde's new PLASMARC Torch, working in the temperature range between 15,000 and 30,000 degrees K., can melt parts or form shapes of virtually any size or complexity. It's an entirely new way to make such articles as reactor nozzles, crucibles, components for electronic and X-ray use, and parts for atomic energy equipment.

The quality of these pieces is uniformly high. Tolerances can be held to $\pm .002$ in. or better. The metal

loss rate of in purity and superior density is minimal.

With the PLASMARC Torch, Linde is equipped to supply you with parts made of or coated with, refractory metals or metals or a variety of metals combined with non-metals or reinforced plastics. Linde will also provide a wide-spectrum materials testing service based on this device. For information on the extension of Linde's well-known Flame-Floating service, write Dept. AW-12, Linde Company, Division of Union Carbide Corporation, 26 East 45th Street, New York 17, N.Y. In Canada: Union Carbide Company, Division of Union Carbide Canada Limited,



The PLASMARC Torch employs a non-transformed electric arc to generate such high temperatures that parts can be melted and the molten metal literally pulled from parent metal by the electrodes. Linde parts being manufactured currently cover the widest varieties in a plasma torch and consist of items on the novelties of non-ferrous metals, lots of CO₂ and the preticles intended to form heat and electron-beam heated crucibles—items are graphite—have an excellent record. Plasma arc joints on non-ferrous materials, which are then melted away to form parts such as those shown above.

Linde
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"Linde," "Union Carbide" and "Plasmarc" are trade marks of Union Carbide Corporation.

Washington Roundup

President Views Defense

President Eisenhower said last week that if Congress goes to voting to raise the Defense Department by \$1.5 billion, and Marine Corps strength is increased by 10,000, he would not put these increases into effect before the end of the year. "I expect to put some place where it's wise to keep them out of the way, because I don't know what else to do with them."

The President had been asked at his press conference why he got "the right to throw the oil of Congress" in casting away and the Marine Corps strength increasing to spend money given him for surplus, etc. He said he thought it was a bunch of mistakes and I think in the past this have made many men feel uncertain in dealing with defense. "All right, I'm going to correct them."

Another reporter mentioned the charge that the Administration plans a balanced budget short of national security and asked if the President could spend more on the same kind of budget. He said, "I'm going to stop it."

The President said he would not—"I've got tired of talking about the idea of a balanced budget against national security," he said. "That—I don't see where this thing ever comes into it. I care that a balanced budget in the long run is a vital part of national security."

"We don't know how we're going to get right up and say, 'I want \$5,000 more,' and maybe this won't then overturn because they'll be ashamed of not convenient places and—why doesn't the air, but we want the tax cut?"

Rep. John McCains (D-Mass.), House majority leader, recently urged the President to call for higher taxes if this is necessary to finance greater defense spending within a balanced budget (AW Feb. 16, p. 25). And following the Eisenhower statement, Sen. Stuart Symington (D-N.J.) echoed McCains's earlier position, saying if higher taxes are needed to support an adequate defense program "we certainly ought to have done."

Pluto Slowdown

Major slowdown in the Pluto nuclear reactor project (AW Oct. 13, p. 33) is also being forced in Budget Bureau Atomic Energy Commission's report of \$16 million construction funds for fiscal 1957 was cut to \$5 million. In addition, Budget Bureau withheld all fiscal 1957 construction funds for six months, did not release those for construction until January. Members of the Joint Congressional Atomic Energy Committee, after concluding hearings sessions, are scheduled to present on two other atomic AEC projects—Reactor nuclear reactor project, and the Swap project to develop several small auxiliary atomic powerplants.

McElroy's Deployment Schedule

In another area, Defense Secretary Neil McElroy hopes to have government service before the end of the year in his former office at the head of Prudhoe and Gladue Co. where he had served as president before coming to Washington. Chairmanship comes with it a large stock option plan. At a recent press conference, McElroy said:

"I am staying on in this assignment, as I announced when I came in, at the pleasure of the President. There

is, as the President knew, certain personnel listed in our file which other agencies may regard as devious below the consciousness of this Administration's total knowledge. Our responsibility is to remove these names before the end of the year. I expect to do this through the day session of the Congress. I expect to be here in the setting off of the principles of the 1963 appropriations budget."

Schriever, ARDC Head?

Also noted by Maj. Gen. Bernard Schriever, now head of USAF's Ballistic Missile Division, to be named commander of the Air Research and Development Command, replacing Lt. Gen. Samuel Anderton, who for health left this post on Jan. 13 to become commander of the Air Materiel Command.

Judgeship for Durfee?

On the east side of the Administration, one of two top contenders for appointment to the judgeship of the Federal Court of Claims is chairman of the Civil Aviation Board James D. Durfee who, along with the panel which always has him in self-chancery, is noting that the Federal Aviation Agency will have a major voice in the presidential nomination of Durfee's successor in order to ensure close cooperation between the Board and the new agency. Another Board position will open the end of this year when Horace D. Denney's term as a board member expires.

CAB Probe of ATA

As Civil Aviation Board last week began a full-scale inspection and review of the Air Transport Assn., the first since 1948 when ATA's articles of association were first approved by the Board. Of particular interest to the Board will be an investigation of the financial position of class 3A as associations and contributions by the members' members. The Board also emphasized its own order calling for the suspension that it wants "to determine to what extent, if any, the organization is in excess of all funds through the various assets of the ATA." In its review, the Board will look into "changes, transfers and grants of all kinds of members, committees, board of directors' compensation and election boards" and all other accounts and assets.

IDA Personnel

In Congress, the House Military Operations Subcomm. is focusing on industry construction of the personnel employed by the Institute of Defense Analysis. IDA was organized with a \$100,000 grant from Ford Foundation to supply the personnel for technical evaluation studies for Department of Defense. Garrison Norton, former Assistant Secretary of Navy, is president. Albert G. Hall, former physics professor of Massachusetts Institute of Technology, is vice president. Initially, IDA borrowed personnel from universities and industry for Defense Department studies, but, at present, 40 personnel are directly employed by IDA. Hall told the subcommittee that the personnel that personnel who do temporary service with IDA to obtain basic defense indoctrination of high value to industry is "a very great concern." —Washington staff



Over-Temperature Indication Cuts X-15 Flight Check

North American Aviation's X-15 research aircraft was cleared last Friday for 70 minutes, but much of the first time, along under the right wing of a Boeing B-52, because over-temperature flight was just about at that point when an over-temperature indication was registered in the rocket-powered aircraft. Over-temperature protection was possibly connected with a supply of hydrogen peroxide monopropellant stored aboard the X-15 since it is required in operation of part of the jet reaction control system. Some compressor trouble was observed. With NASA test pilot Scott Crossfield at the X-15 controls, stability augmentation and communication systems were checked during the flight, which reached an altitude of 35,000 ft, and a speed of Mach 0.5. Boeing B-52 mother ship was piloted by Capt Charles C. Bork, Jr., and three chase planes accompanied it. North American plans to make about 20 flights in its stratospheric altitude research program on the first X-15. Future flights are expected to be made on the second and third X-15 vehicles, since a large amount of B-52-X-15 compatibility work already will have been accomplished, plus a certain amount of structural and systems panel work.

the possible financial risks inherent in involving aerospace production units.

Gen. Taylor and friends for Army surface-to-surface missile programs fall substantially short of those needed to yield the goals recommended by the Joint Chiefs of Staff, and which he felt were important to the service, the coverage that will result from the Reserve program cannot be justified by the budget at substantially less than what the Air Force originally intended.

Gen. White told the congressional that, while certain scientific findings do not fit the U.S. needs to begin construction of a nuclear-powered aircraft, he considers the program sufficiently advanced that construction of a prototype aircraft could proceed and the propulsion phase of the program accelerated.

Later, Rep. Melvin Price (D-Ill.), chairman of the Joint Congressional Inquiry, when questioned on an attack and displacement pointed to Gen. White's statement as "further evidence" of the importance attached by military experts to accelerating the aircraft nuclear propulsion program.

"It is clear," Price said, "that Gen-

White and his expect military interests believe enough that the program is sufficiently advanced technically to warrant the commencement of work on an aircraft and propulsion system suitable for first flight."

Gen. White and the Air Force out-

line cooperation program is assigned in terms of support type facilities and does not provide for the construction and growing deficit in man-years equates important areas. Also, he said, the Parallel 1960 Air Force operations and maintenance costs were estimated and will result from the Reserve program cannot be justified by the budget at substantially less than what the Air Force originally intended.

In order to minimize Navy expenditures, Adm. Butler said more funds should have been provided for maintenance and modernization of ships and aircraft procurement of new ships, aircraft, guided missiles and other associated electronic equipment, acceleration of maintenance service progress, procurement of fleet ballistic missile weapon systems and increased research and development effort.

Gen. Price told the congressional he felt the Minuteman Corps requires procurement to adequately meet basic division and three aircraft wings and therefore calculated strength at 380-400. The budget provides for only F71,000.

Hawk Cat

Washington—Army disclosed last week that its Hawk猫 low-level attack drone will not be deployed at test installations in the U.S. and that it has formally abandoned plans to integrate the Navy-developed Tropic defense module into its program "because we would not afford it." Army had planned to couple the Hawk with the high altitude Nike missile for all-around defense. The project, however, was rejected by the Joint Chiefs of Staff. Hawk may still be used by NASA, however.

Boeing 707 Development Writeoffs Shave \$9 Million From Earnings

New York—Heavy development writeoffs for the 707 jet transport plan, a carry-over from shipping about \$9 million from Boeing Airlines Co. to commercial customers, will offset a loss another addition to the company's writeoff in its progress to Dec. 31, 1965, on the 707 program to estimate proposed model sales value based on the quantity of airplanes scheduled for production, the company said.

Larger写offs taken this year also will be a factor, the company reported. Losses from the B-52 bomber and B-58 strategic missile from cost overruns and type rewrites to final price contract basis will bring earnings on these programs to low levels in the first half of 1966.

Boeing's 1965 sales of \$1,711,879,356 were at all time high for the company—the previous record was \$1,700,511 in 1957—and sales were 3% higher than in 1964, reflecting the all-time sales high in aircraft engines, propellers, aircraft structures and well-built aircraft produced in the U.S. (AWW, Mar. 10, 1965, p. 25).

Stressed by the company, however, was the lack of effect the housing sales total had on earnings, which dropped from \$181,000,000 in 1957 to \$20,000,000 last year. Boeing's 1965 profit margin on sales was only 1.7%, a drop even from 1957's meager 2.1% figure. Total sales margin last year was 54.01 compared with 51.38 the year before.

A calamitous loss is being recorded on 707 designs or on earlier hand on the current order book but the company's management suggested some changes to turn the program into a winning one on a point of return.

Written off 707 residuals, develop-

ment, administrative and other general expenses were approximately \$34 million in 1958. In addition, there were charged against earnings a \$16 million loss on the company's investment in the aircraft in its progress to Dec. 31, 1965, on the 707 program to estimate proposed model sales value based on the quantity of airplanes scheduled for production, the company said.

Total charges, including the prototype cost, have amounted to \$4 million since the program began in 1952.

The Los Angeles Regional Manager said he recommended that Boeing make a \$6 million release for his retirement. Boeing's reason: funding of experimental aircraft will bring immediate profits to the U.S. Tax Court (AWW, Mar. 10, 1965, p. 25).

Other 1965 financial reports:

- Transocean Corp. sales were \$214 million and earnings were \$2.5 million in 1965, with both sales and profits holding at the same level experienced in the previous year. Transocean reported earnings for last year were \$2,975,000, or \$1.33 a share, up a slight increase from the figure of \$2,910,000 and \$1.45 a share for 1957. Total sales dropped slightly from \$1,169,160,000 in 1957 to \$1,169,100,000 last year. But, at the end of 1965, the stock was about \$165 million.

On 707 residuals, development, administrative and other general expenses were \$16 million in 1958. In addition, there was a charge of \$1.3 million for the 707 program last year.

Vanguard Wobbling Humpers Data Return

United Aircraft Earnings

United Aircraft Corp. last week reported sales and earnings in 1965 were record early to 1970's overall corporate target. Company financial development, placement of state products and United's own decision to enhance its technical capabilities explained what drove these results, the company said.

Sales were \$10,320,821,867 compared with \$10,212,919,345 in 1957. Earnings declined by \$1,000,000 in 1957 to \$43,384,726. Major engine division sales were down 10% during 1957, but commercial engine division will rise in 1966, the company said. Honeywell-owned costs in the space and missile field will continue, but will affect 1965 earnings if no government report is released for projects.

Scaling off the end of 1965 was \$4,400 million compared with \$1,617 million at Mar. 7—about four days after they were reported to the Vanguard II had made

Discoverer I Orbit

Los Angeles—Discoverer I, polarized satellite built from Vandenberg AFB Site 4, is reported to have been injected roughly 100 miles above California in the vicinity of Point Mugu. Early radio link work although official confirmation was not available.

Previous flights of 41 tracking reports have been recalled by additional radio contacts, including signals received by General Electric's Elettra station which was the source utilized based on an analysis of signals by successive tracking of the satellite as it moved through the Spanish and the southern radio beams, still operative, indicating that the satellite is indeed around 100 miles above the ground.

Most recent signals indicate the orbiting period of Discoverer I is 101.660 min., perigee 77.6 mi, apogee 379.6 mi. Life of the satellite is expected to extend beyond 30 days from launch date.

• Total radio links (radio sightings) have been selected. Present analysis, using assumed stage would present a 19.01 degree target for a radio beam. Thus far, and the satellite would offer only a 1.01 degree subtense, making radio use difficult.

211 orbits of the earth and had been interrogated successfully. 142 passes to ground stations. On 79 orbits, it did not pass within range of an intercepting receiver. Recovered about 50 sets of data and transmitted it on signal to 90 sets. Signals 15.45 and 15.46 were also detected. The satellite was in general when temperature remained within the range of the 111F design temperature, but has a subtle spending about 60% of its time in sunlight.

Reckoned orbital figures for Vanguard II as of Feb. 14 are:

- Apogee—7,005 mi., perigee velocity 15,050 mph
- Perigee—140.9 mi., geocentric velocity 15,117 mph
- Orbital period—135.61 mi.
- Inclination to equator—32.809 deg.

Civil Jetstar Order

Lockheed Aircraft Corp. will deliver the first corporate Jetstar aircraft to Continental Can Co. by Jan. 31, 1966. Approximately 70 passenger options will be held by Lockheed and the company is negotiating on contract seating, delivery dates, types of engine and speed-up issues. Corporate versions will be powered with either two or four engines, depending on customer preference. Jetstars are flying with British Overseas Airways Corp. Four-engine versions will be PWJW J12s.

NASA Reports Data On Pioneer IV Orbit

Washington—More precise figures for the Pioneer IV interplanetary probe's orbit around the sun were reported last week by National Aeronautics and Space Administration's Jet Propulsion Laboratory. New figures are:

- Period—394.7 days
- Average speed in orbit—64,000 mph
- Perihelion—91.7 million mi., to be reached at 9 p.m. EST on Mar. 9, with a speed of 40,000 mph
- Aphelion—189.1 million mi., to be reached at 6 a.m. EST on Oct. 1, with a speed of 60,000 mph
- Current approach to mercury—17,300 mi., a journey of 2.2 deg ahead and 1.7 deg north of the mean, at a speed of 4,000 mph. Desired closest approach was 20,000 mi. At closest pass, probe will 21,000 mi. from the earth.
- Tracking—Probe was tracked for 43 hr. and four minutes after launch to a distance from earth of 407,000 mi. Last signal transmission was at 10:24 a.m. EST on Feb. 6 to the 50-ft. dish antenna at the Goldstone Deep Space Network station in California, which had passed the transmitter for four hours on the ground before launch.

• Launching—Tosses in trajectory included more 4.5 deg. in elevation and plus 1.1 deg. in azimuth. Mean orbital velocity was 24,700 mph, or 195 mph below the desired velocity.

- Next approach to earth—July 1, at a distance of something near than 18 million mi.

• Instrumentation—Geiger Mueller tubes indicated radiation levels were the same as of last directly related. Probe sensor did not work because sensor's range at 37,100 mi was not large enough to include it. Doppler quadrature did work, although Doppler ratio rose to 40% at injection and remained there.

- Accelerating mode—2 sec. EST on

Saturday, Sept. 12, 1970, of which time the Pioneer IV's orbit will have increased to the expected 10.127.

For more information, see news release on Soviet Russia's Merkury Probe (IAW Jan. 12, p. 26).

- Prokhorov—\$1 million mi. on Jun. 12, 1972

• Aphelion—110 million mi., Aug. 21, 1973

• Period—413 days

• Average speed in orbit—61,100 mph

• Tracking—6 hr. in a different Earth epoch of 378,000 mi.

Radiation Belt Data Reviewed by Soviets

Moscow—Radiation belts around the earth are more intense than originally believed, according to data announced from the Soviet Union's cosmic rocket and astrophysics division.

S. V. Vinogradov, corresponding member of the Soviet Academy of Sciences, and his laboratory colleagues A. Chudakov, and S. M. Goryainov, said the data indicates that measured probe velocities will measure relatively less shielding from X rays they had been expected. This was noted.

• Low-energy electrons are circling the earth at altitudes of up to 10,000 mi, but their energy is relatively small, ranging from 30,000 to 100,000 electron volts.

• Cosmic radiation intensity at great distances from the earth is "highly low," with only two particles passing through one square centimeter every second. At distances beyond approximately 30,000 mi, the intensity does not change.

• Data showed experimentally that electrons moving around the earth move in three modes, meandering "for a very long time" while located in a magnetic trap created near the earth by the earth's magnetic field. These phenomena are similar to what takes place in metathorax when physicians are trying to produce thermoluminescence.

At a height of 9,100 mi, there are 200 times more particles than at a height of 750 mi on the sun, but of lower energy.

The manner that all the 70 particles at 9,100 mi, can use their data to a law of trade.

All others enter along the line of force, going from one hemisphere to another and back, and do not go down to low altitude.

The article said that these are grounds to conclude that the inner zone of intensive radiation around the earth consists exactly of systems, though no details are given. "Electrons of the outer zone penetrate energies which are relatively small."

Space Technology

Military Limits Space Effort to 600 Mi.

By Fred Eastman

Washington—Military space efforts in the immediate future will be limited to 600 mi above the earth, according to Ray W. Johnson, director of Defense Department's Advanced Research Projects Agency.

Johnson told the House Committee on Science and Astronautics during discussions of the military's space program last week that, although they did not appear to be any present need for the missile's several old odd jobs, the immediate future is being concentrated as building military hardware to maximize war effort in this zone, he said.

Transfer of the laser probe study from ARPA to the National Aeronautics and Space Administration by the President was a clear indication that probes in the air and of the moon were outside the military purview, at least for the present, Johnson said.

He also noted that, in this zone, the development of military satellites with space outside the 600-mi limit when technology has advanced to the point to indicate there were military requirements beyond this zone. The one exception seen at this time, he said, is the 25.5-in. stationary satellite scheduled to be placed into orbit at 22,000 mi in the communications satellite program.

ARPA Developments

On other aspects of ARPA's assigned role in military space technology, projectile elements and ballistic warheads were the main concern.

• Four contracts have been awarded for weapons research activities in solid projectiles. This work, funded in scope, involves projectile retarding studies, thermodynamics, thermodynamics and performance calculations, projectile formulation, projects on explosives and explosives related chemical engineering and research. Initial objective is development of solid projectiles having specific impaction 10 to 20% higher than those now available.

• Government-owned vehicle programs. One research program activities are research and development of ballistic reentry vehicles, solid propellant and solid composite reentry and reentry and characterization. Overall objective of the major ARPA program, including industrial research contracts and contracts with universities and non-profit organizations (IAW No. 5, p. 5), is the discovery of new chemicals, development of novel methods of pro-

cessing and obtaining the knowledge required to obtain these materials in practical and highly efficient solid projectiles.

• Later phases of the Defense's space programs are the Central Atlas intercontinental ballistic missile assault as a booster for larger payload capabilities still later. He said the program might involve the use of 100-ft. diameter boosters being developed by NASA's Project Poseidon satellite cable for launching one vehicle a month for the remainder of the calendar year.

• Navigation satellite program is planned to provide an instantaneous worldwide system for determining position at any point on the globe. In passive version, receiving station will listen to radio frequency signals transmitted by the satellite as it passes over the horizon. Signal is initially shifted up by the Doppler shift due to the satellite rate of approach to the receiver. Satellite will return to the receiving station the signal for the Doppler shift so that the receiving station can calculate signal frequency and coded signal signifying the orbital elements in effect. By using that as input, the position may be located within four hours of a mile.

• Four nuclear clusterbomber satellites are expected to be delivered to Mr. along with its other satellites for television entertainment and other tests. Post launching, with an estimated life of five months, will be attempted in July or August, the second in February or March of next year. There cannot, still find pictures into separate ring some type number for photons as command. A thousand pictures will be produced every 24 hr. with each picture showing a detail as 500 television lines per inch.

• ARPA maintains a future act for a command and data communication satellite to serve as either U.S. representative, including NASA, AFPA and any other organization engaged in space activities. It would, Johnson said, be responsible for categorizing all space vehicles, and the program should call for broad goals in data exchange as well as data analysis and data and data fusion.

• Advanced interests in the development of a missile defense assigned to AFPA in Project Burn. This has ramifications on a classified federal agency. Another interest is a second satellite to observe damage from the Atlantic Missile Range. Another program concerns the solar wind probe, which is equipped with a large array of sensors and equipment. In addition, research modes are being installed at Wallops Island to achieve small rocket flights and aircrafts are being instrumented with optical and infrared instruments to study atmospheric processes that take place during launch and events of a ballistic missile.

Military Aviation Funds

The military services left unassigned billions for new spending in aircraft and guided missiles of \$6.2 billion on Jan. 1. The unexpended balance totaled \$69.5 billion. Following are details released by Department of Defense.

Aircraft	Engines	Prop.	COMBINED FUNDING (Jan. 1, 1971)		EXPENDITURES (Jan. 1, 1971)	
			Unexpended	Balanced	Unexpended	Balanced
July 1, 1970					July 1, 1971	
through					through	
Dec. 31, 1970					Dec. 31, 1971	
Total			6,309,011	3,932,860	14,181,717	
Control Models						
Air Force			1,095,395	7,766,912	9,821,497	3,931,634
Air	462,365	2,280,191	1,070,346	4,330,819		
Army	28,400	13,88014	76,276	147,967		
Total	1,126,815	7,766,912	9,821,497	3,931,634		
Flight and Communications Equipment						
Air Force			274,324	749,314	181,910	1,624,567
Air	90,074	256,334	51,495	612,319		
Army	194,660	45,342	23,494	308,416		
Total	90,074	256,334	51,495	612,319		
			2,301,413	2,706,205	1,546,415	6,151,764

Work Starts on Vandenberg Titan Silo

Part of the first intercontinental ballistic missile underground shot a safer construction at Vandenberg AFB, Calif., where the owners will be primarily testing although operational capability will be provided (IAW Mar. 5, p. 12). Layout will be similar to Titus base at Lewis AFB, Colo., except the Lewis complex will include rats also.

U.S. Space Lag Blamed on Bureaucracy

Los Angeles—United States is lagging behind Russia in the space race, largely due to a dearth of technical talent, but also because of a lack of business entity skills," according to Sen. Clark English (D-Calif.).

Speaking at the Western Space Age Conference sponsored by the Los Angeles Chamber of Commerce, English said a surplus of government agencies and congressional committees hinders industry's efforts to progress. Citing Dr. Wernher von Braun's experience as director of the Development Division of the Army Ballistic Missile Agency, he said von Braun had been unable to get the Pentagon for committee hearings. "And if that wasn't enough, from time to time the committees visited the Huntsville project," English said.

Man-in-space projects are an example

of how project development overlaps, resulting in a "honeycomb development process" where one federal agency can do more than another. "There are presently five major space programs, one by the Army, Navy, Air Force, National Aeronautics and Space Administration and Advanced Research Projects Agency. Eagle went to say, too, "Bupfy, the Marine Corps does not have a man-in-space program."

The Senator also cited the proliferation of agencies and "mass" advancing the President's space policy. "Here is an example of the 'mass' in bureaucracy: bring in the National Science Foundation, the National Science Board, the Chief Scientist, Advisor, Director R. K. Kalman, Jr., the Federal Council of Science and Technology (president), the President's Scientific Advisory Council,

the spatial station advisor, Gen. Elmer Quisenberry, the National Security Council, the Federal Aviation Agency, NASA, the Bureau of Standards, and the Department of Defense with all its subordination such as ARPA and guided missiles and the military services. If Mr. Eisenhower wanted to know about the value of a certain proposal, I doubt if he would be sure where to turn or whether he could get better information from someone other than the agency he was consulting."

Sen. English and he didn't know all the answers to the problems plaguing contractors as a result of excessive government administration, but that is not an insurmountable challenge to the men of government to prove our ability over Russian counterparts.

Mossie Retires

Doublets of the military valor of a nuclear-propelled bomber (see p. 67) were selected during the conference by F. A. Cleveland, chief aircraft design engineer for Lockheed Aircraft Corp.'s Georgia Division. He said the concept of missile reentry vehicles is useful unless a strength of the reentry vehicle is an ultrathin skin against attack.

* Retention forces is capable of finding and destroying enemy mobile strategic striking forces as well as large fixed targets.

The last point is important since it is the requirement that we be capable of winning the war if the deterrent threat fails. A nuclear bomber, being unarmed, has the capability of seeking out the difficult targets and risking comparatively vulnerable low altitude strike operations because gains due to increased potential location, fuel savings does not demand a high altitude approach.

The trend in development of bombers has been toward greater speed and higher altitude and distance systems have been oriented to cope with these traits. Such an orientation has tremendous merit because the defense system is no complex consisting of missiles, aircraft, warning, search and tracking equipment and an extensive communication and data processing network. Recent reports of the effect on aircraft range of high altitude systems leads indicate that reliance may in the high altitude approach can be increased significantly. Cleveland and Bard, USAF and Lockheed studies indicate that reliance due to early defense would be relatively slow in the low altitude approach. Evolving chemical-fueled bombers can use fix-

low altitude approach but reduce it to a sharp bustle. Only solid propellants offer combination of performance and range at low altitude.

A high altitude booster passing near a radar station can be detected for over 15 min but one passing at minimum altitude can be detected for only three minutes. Studies show that over 40 hours of radar coverage are needed to cover a flight during penetration against low flying intruders at greater high altitude, high speed, ballistic identification and tracking of low altitude aircraft is difficult because the intruder presents the cover with many extremely brief single sightings. The difficulty of identifying and tracking is compounded if there are several intruders simultaneously flying random courses. This comes in faced with an extremely difficult data correlation problem.

Interception and track are difficult because of the brief range of detection and tracking and because an angle close to the horizon does not provide an easy target to achieve radar and infrared detection because of ground clutter. Short warning range means interception lead to get started soon is to take place at which they are likely to expend fuel before getting within range.

Cleveland also described USAF's recharged plan of continuous airborne missile launcher and low level system (CALMAL). He called the airborne conventional except for the various needed to protect against radiation damage. No earned design or filtration methods are required to protect against radiation damage. The proposed system is a dual, which is in a rapidly developing state, as also developed by India's state of the art, basic concept regarding whether has been evaluated, tested and refined as the laboratory or in the actual hardware itself." He and White, thinking on CALMAL is very heavy, it does not approach the weight of fuel consumed in use of surface power Cleveland said.

* CALMAL is as large flora present Strategic Air Command bombers.

- * CALMAL cannot meet planned than present Strategic Air Command bombers.
- * It will be able to exceed range over hours per year than current bombers after it reaches full operational status.
- * It can operate from present locations of SAC bases.

* One mission will last just over than one week in the air despite the absence of significant loss in range or calendar and despite the fact that shielding will prevent crews to do same number of hours per year in in conventional aircraft for 18 tons without exceeding AEC limits.

* It can launch long range atmospheric missiles against interdicted targets and then live in at low altitude for attacks against hardened installations



General Electric Unveils T64 Turbine Engine

Plant plants shown completed General Electric T64 free turbine engine which has entered development testing at GE's Small Aircraft Engine Dept. Engines being developed under 140 £ million Navy Bureau of Aeronautics contract, uses liquid power section in which individual units can be added to make it either a turboprop or turboshaft engine. (AWW May 20, 1951, p. 14) Engine is rated in the 1,600 shp class.

News Digest

Solid propellant missile market on which the French Ministry of Defense will depend for its surface-to-surface 160 mm of ordnance to orbital stations will be designed developed and supplied. General Control Reper Co. has won a subcontract awarded by McDonnell Aircraft Corp.

British government will contribute half the remaining cost of developing an advanced version of the Tornado fighter/VTOL transport, although the sum has not been revealed.

French Airlines will order four Boeing 727 medium range jet transports for its European and transatlantic routes. The French government sources give the price as \$4.2 million per airplane.

George F. Seaton, Jr., has been named chief scientist of the Advanced Research Projects Agency to fill the post left open in December when Dr. Robert T. Jones, Defense Department's Director of Research and Engineering, last September, resigns. Seaton took a leave of absence to manage the advanced design for Rockwell Division of North American Aviation, Inc. He is former Hammett Professor of Aero-

nautical Engineering at Massachusetts Institute of Technology. Seaton holds Bachelor of Science and Master of Science degrees in mechanical engineering from California Institute of Technology.

Piper Aztec light-twin business plane prototype crashed after undergoing glide tests over Lake Huron, Pa., yesterday killing the pilot, Robert Piggott. Tail of the airplane was found about 26 mi. from the wreckage.

French government is considering placing a launch order for a larger version of the Dassault Mignot IV from its contractor which will be powered by two Pratt & Whitney JT3D-15 engines. Current versions are for fast night and awards is powered by SNECMA Atar 9 engine.

U.S. Army has awarded contracts totaling \$23 million to Bell Helicopter Corp. for production of HU-14A and H-13M turboshaft-powered helicopters.

Radio Corp. of America's Electron Tube Division says it has an approach to development of self-oscillating electron tubes particularly suited for much smaller packages. New design called Novette is suited to reducing both size and power drain and increasing per-



McDonnell Douglas F/A-18 Hornet fighter jet displayed at the Western Space Age Conference sponsored by the Los Angeles Chamber of Commerce.

Latin Rate War Nears Showdown Stage

Predicted settlement of fare cutting dispute not expected to trim foreign-carrier competition.

By L. L. Doty

Miami—Stormy rate-cut war that has raged since '60 when through Latin America and the Caribbean for the past five years finally appears headed for a showdown.

However, any settlement of the conflict, which reached its peak with the under-cutting of established fares by as much as 40% by some South American carriers, is not expected to stem the torrent of competition that has built up against the U.S. airlines. Despite the apparent lull caused by the strong surge of nationalism that has swept the Latin American continent since World War II—all continue to face threats by U.S. carriers to meet that competition squarely.

Most observers here close to the Latin American scene say the last year or so will be a confused one because the under-cutters are now threatened with the possibility of being undercut themselves. Recently, Pan American's chairman of the International Air Transport Association won the right to change fares 10% less than the low rates set by non-members of IATA.

Latest Developments

Here are the latest developments in the airline situation in South America:

- **South American carriers.** The Pan American (IATA Jan. 29, '68) created an air of optimism that as equitable fare patterns could be reached that would bring a halt to cut-throat competition. Participating countries agreed to propose that IATA fare levels would be set as standards in South American rate structures. Meanwhile, present fares have been frozen temporarily by sheer off of all new world air fares, except those of IATA members.
- **Meeting of airline operators in South America.** Scheduled to begin today at Lima for the purpose of setting intra-hemisphere fares properly, U.S. carriers are anxious to ensure that rate of cut-throat exchange and agent competition may not be resolved before any meeting on fares is convened. Observers see the postponement does not indicate a delaying action on the part of South American carriers, but that it simply the result of time-consuming efforts to coordinate all countries on all the issues involved.
- **South American carriers are still determined to impose stiff restrictions on Fifth Freedom traffic.** These airlines are insisting that 75% of all traffic be channeled between two South American countries

Majority of the South American carriers are IATA members, as are all U.S. flag carriers offering scheduled passenger service south of the U.S.-Mexico-Australia Boarder. Pan Am, Pan American, Pan American World Airways, and other following carrier group there are 13 non-members of IATA which refuse to abide by IATA fare standards and offer higher rates by below fares charged by their competitors.

Round Trip Rates

For example, CINTESA, a Chilean airline and non-member of IATA, quotes a one of \$117 round trip between New York and Santiago as compared with the \$79.70 round trip of 1963-64 first-class publications. Transoceanic American Pan Am offers a \$45.50 round trip Miami-Buenos Aires fare in comparison with Pan American's round fare of \$77.90 round trip between the two points.

Attempts to limit such action to take fare cuts to more reasonable levels have failed in the past. Generally, these operators have been able to survive lower revenue because of low costs.

They have purchased streamlined aircraft with low seat-back charges and have been able to compete. In fact, they have had a continual flow of such devices as reducing general equipment from airport operations or otherwise for the short period of time it is actually needed and used. Also the entire large privately owned carrier service to the public profitable routes leaving the less productive areas to IATA carriers.

IATA Conference

To combat these fares, the IATA traffic conference held in Geneva last week (AW Oct. 27, p. 26) adopted a resolution which permitted IATA members to reduce fares and reward fares on South American routes to a level say less than 90% of the lowest fare available on the routes in question. The Civil Aviators Board approved the decision and later submitted it to the 13 members of the IATA conference.

This meeting, to settle disputes that have come up will meet again next month and will deal with specific traffic problems as they are related to rates set to the third parties between the U.S. and Latin American air carriers.

selves under the pledge of IATA oblige.

First signs that harmony could be reached appeared when the South American carriers last fall decided to members of the Association Intergovernmental de Transportacion, a task-force association of the Latin American carriers. At that time, Jose Perez, head of IATA, attempted to notify the low rates but acknowledged that some refinement might be required. Robert Beria, president of Brazil's Varig and IATA members let the name to resolve the fare issue.

However, the first situation is not the only factor that has inhibited U.S. carriers in meeting South American competition on even terms. There also elements—namely, the political aspect of the matter and the general concept of traffic also by U.S. flag carriers from operating in a free market.

The first two of these items were apparently headed for a settlement as a result of agreements reached at the January Rio de Janeiro meeting. In fact if they are not resolved, U.S. carriers see little point in any further discussion of fair travel since both the agency's representatives and carriers including them, as they stand, could cause a continuation of sharp fare differentials.

On the monetary exchange problem, a general agreement on the U.S. dollar and how it is to stand in the construction of fares. In addition, it was decided that a free market rate of exchange will be adopted as a means of stopping the spiraling inflation of prices on airline travel.

Such inflation has provided South American carriers with a net profit of as much as 10 to 20 cents on the dollar.

For example, normal rate of exchange is Chile about 1,050 pesos to the dollar. However, airline tickets are being sold by some airlines at a rate of \$150 to \$180 pesos to the dollar to create a tremendous competitive advantage over carriers selling similar tickets in dollars at the open market dollar exchange rate.

Use of the dollar as a standard for fare construction and the adoption of a fixed market rate of exchange will probably U.S. carriers that all participants at any point of purchase are paying an equal value for tickets purchased by fares any two points.

Second item on which agreement is also reported consists having charged that high-speed aircraft of as much as 70% discounts for round trips between Argentina and some other countries do not necessarily go to the travel agent, large portion of the passengers are allegedly paid as a rebate to passengers purchasing the tickets at a below cost of giving a reduced rate on tickets.

Unresolved last week were significant increases IATA and its pilots, whose contract expired last October. The contract chapter is so ambiguous, however, as to whether it will be question of a strike at least until October Labor Act procedures and negotiations passed

TWA to Start Jet Flights; Seems Sure of Getting More 707s Soon

By Glenn Garrison

New York—TWA Airlines' plane to begin international jet service Friday with a single Boeing 707-120 is probably based on erroneous additional information, although Howard Hughes' original intent never last week still surrounded TWA's first jet flights.

Tenth TWA airplane, however, is scheduled to leave Los Angeles at 10:45 a.m. Friday for Paris. Two of the jets were at the Boeing Field maintenance delivery center last week in TWA's own markings. Four were on the preflight list at Roswell, and two were on the factory ship for final checklist.

Airliner arrived in East jet aircraft weeks ago and has been using it for training, but that is not NP governmentally registered airplane, and cannot be used for backup in the scheduled service until its registration is changed. First NY International arrival was due at Kansas City last week and that plane will assume the usual communications role.

Hughes Tool Co., which takes delivery on TWA planes and retains them in the airline, obviously has retained at least some financing for its purchases, because living loans on its jets only after final payment has been made. The two planes turned over so far apparently were paid for in full after they were delivered at Kansas City.

While TWA still does not specify as to its equipment purchases through Hughes Tool, bookkeeping procedures of the jet jet have been set up to keep track of the cost of the aircraft to be leased. The first TWA jet, a Boeing 707-120, was leased to Hughes Tool Co. TWA's Bert of Los Angeles Generalization was leased that way, and will be a customer of him when he comes to the airline. Civil Aviation Board recently approved lease of the first 707-120 to TWA by Hughes Tool, and permission for the jet will be required by the airline in the same manner as the Constitution.

First TWA jet schedule is expected to depart San Francisco Friday after noon for New York, and the airline's second flight will begin Saturday. The morning service will commence Mar. 3 after a longer slate consisting of TWA's jet scheduling.

Unresolved last week were significant increases IATA and its pilots, whose contract expired last October. The contract chapter is so ambiguous, however, as to whether it will be question of a strike at least until October Labor Act procedures and negotiations passed

are exhausted. The airline last week signed with Flight Engineers International Airline, guaranteeing the railroad employees engaged at jobs until January 1961.

TWA is prepared to begin jet service with supervisory pilots if that becomes necessary. Line pilots have been taking flight and ground jet training, and the airline's first two jets are due to fly fully checked out pilots by start of service. Boeing 707-120s scheduled was put into use earlier this month.

TWA's first jet flies 46 first class and 65 coach seats on its jets on the New York-San Francisco run. Scheduled times are 4 hr. 40 min. eastbound and 5 hr. 45 min. westbound. Dark departure from San Francisco is scheduled at 2:30 p.m. local time and the New York departure at 9:30 a.m. local.

By way of comparison, American Airlines' round trip San-McGuire-Angles is about four hours and 20 min. and Pan American's flight takes about the same amount of time. The first flight of the 707-120 and American was able to inaugurate service from both cities simultaneously.

TWA will perform 10 basic long-haul routes at New York, with twice weekly services at San Francisco. Routine overhead procedure that work was still undecided, TWA said. The airline has been negotiating for possible outside ownership of the Pratt & Whitney J58, but had not definitely made up its mind whether the engine would be used or whether the engines would be concentrated at TWA's new Kansas City maintenance base. The base is not yet ready for jet work.

The engine has been accumulating ground experience for its jets and a new off-shelf aircraft to handle three Engine and defense parts are planned to various stations.

For major route, TWA has both the Aer star shuttle and Boeing TriStar routes at liftoff. One TriStar has not been delivered and another is on order. Experience will determine which will be regularized.

The airline's right for getting an engineering 707-320s ride enforcement will be validated to be sometime this fall.

Construction of the futuristic design TWA building (partnered in AW Nov. 15, 1967, p. 40) has been delayed, according to Hughes' then-unverified cost estimates. Basis for the construction runs in excess of \$31 million, TWA said, although only \$25 million had been voted for the project.



World's newest, fastest long-range jetliner...

The Boeing 707 Intercontinental, shown above on its first flight, will bring a new order of performance to the air routes of the world when it goes into service later this year.

This new Boeing jetliner has greater range and payload capabilities than any other jet transport. With a range in excess of 5,000 miles with full

payload, it is designed to fly nonstop over the longest stages of airline routes. Cruise speed is more than 600 miles per hour.

The Intercontinental is a longer-range sistership of the 707 Stratoliner. Although it is the world's newest long-range jetliner, the Intercontinental is a proven aircraft...backed by more than 400 years

the Boeing 707 INTERCONTINENTAL

of flight testing of the 707 prototype, as well as extensive test programs completed by production 707s. In service since last October, the 707 Stratoliner has been demonstrating the unsurpassed passenger appeal of Boeing jets. Public response, in the words of the opening airline, is "the most enthusiastic to a new product in aviation history."

These airlines have selected 707 and earlier range 720 jetliners (*indicates international purchases):

*AIR FRANCE • *AIR INDIA • AIRFRANCE • *AUSTRALIAN AIRWAYS • CONTINENTAL • DULANEY • *FLIGHTS OF FRANCE • PAN AMERICAN • QANTAS • SOUTH AFRICAN AIRLINES • UNITED • VARIG • *VIRGIN AIRLINES

BOEING 707 *Intercontinental*



First Boeing 707-320 Intercontinental Taxiing

First Boeing 707-320 Intercontinental, now undergoing Federal Aviation Agency certification tests, has had its first flight at Seattle, Wash. In background is the second Intercontinental, both aircraft will enter service for Pan American World Airways following certification. A total of 14 Intercontinentals have been ordered by nine airlines.

engine in the form of a more gear and lighter instruments, however, would increase weight before the payload. Present all-around weight of the aircraft will become a necessity, but Los Angeles Airways anticipates that advances in the state of the art will permit equipping a helicopter for that capability without the compromise in payload and performance that would be incurred with equipment presently available. Unquestionably, the \$41, a helicopter with the passenger carrying capacity of the 707, will need more sophisticated navigation methods than are now employed. While preliminary studies are under way by Los Angeles Airways, no plans have as yet been made to take this route.

Another study should point up the type options required by Los Angeles Airways. This is distance flown per passenger. Thus, the 11,651 revenue passengers carried in 1968, passenger miles basis, took an average of 1,186,000, or slightly less than 37 miles per passenger. The 707's range is approximately 5,700 miles based on 70% capacity, passenger weight about 30,000, getting to 100 destination by helicopter. By comparison, on public surface transportation, which averages 9.5 mph as stated before, he would have to spend about four hours covering the same distance.

Los Angeles Airways' first certificate renewal was presented recently to the Civil Aviation Authority Board on Dec. 8, 1968.

In citing the rate for renewal,

the board noted:

"After consideration of all pertinent factors, it is recommended that the certificate be renewed for one year, subject to the payment of the renewal fee."

The renewal fee was set at \$1,000.

As part of the decision, Los Angeles Airways exhibited a letter of intent from Bank of America to C. M. Johnson, EAA president, to extend credit on the amount necessary for the purchase of

the new equipment. Johnson stated that introduction of the new equipment, following time for flattening of the learning curve, could mean a wholly-free operation. But economic opinion on the time to release subsidy would be 1965.

British Aircraft Cost Estimates Attacked

London-British Airlines General has issued a report strongly critical of estimates between original estimates and actual costs in development of radar search and aircraft engines.

Sir Edward Compton, controller and auditor general, gave three major examples in the cost appraisals inaccurate and erroneous.

Development cost estimates of the de Havilland Sea Vixen, small version of the DH116, originally set at \$16.6 million, were exceeded by \$13.7 million. Total estimated production costs have since been raised to \$19.5 million.

"Government's contribution to development of the Boulton-Paul Avro RA 250 engine for the Comet IV was first estimated at \$16 million but the Ministry of Supply said final liability amounted to \$24.5 million. Government failed to terminate the development contract when the estimate reached \$21.1 million, but found it would be liable for heavy breach of contract damages, largely because of de Havilland's management of the project, Comet IV's in Boulton and other contractors."

"Estimates on development of the Bristol Denge, which was to have replaced the Trident as the British transatlantic, came from \$15.2 million to \$35 million before the Ministry of Supply withdrew its support last year."

Sir Edward also cited the case of a radio receiver, estimates for which rose from \$10,000 to the time of contract award in 1951 to \$3.5 million last year. The reason given was various increases given by the Ministry, mainly for the development, chiefly the redesign of samples work in test cells, and misunderstandings between suppliers and government over what was calculated.

In the case of the Comet, Sir Edward held that the Ministry of Supply, after taking into account the cost of the aircraft, had been granted a sum which did not reflect the cost of the new equipment. Cost of the \$61 aircraft at about \$375,000, or a total projected cost of \$1,075,000, during the period 1951-63.

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the new equipment. Johnson stated that introduction of the new equipment, following time for flattening of the learning curve, could mean a wholly-free operation. But economic opinion on the time to release subsidy would be 1965.

SHORTLINES

► **American Airlines** flew an estimated 164 million revenue passenger miles during February, an increase of 317 million passenger miles from an February, 1968. Red letters for the first six weeks of Boeing 707-320 intercontinental operations totalled \$4.25 million.

► **British Overseas Airways Corp.** claims a new Tokyo-Honolulu speed record with a British Britannia airplane. The flight was made en route to Japan by BOAC's flight for round the world jet service via Britain and the Marshall Islands. Comet 4 aircraft.

► **Continental Airlines** has completed delivery of its eighth prime aircraft with the sale of three Convair 840s to Air France. The airline has sold some 14 aircraft for \$5,200,000 in 13 months.

► **Flying Tiger Line** reports a company record for January revenue—\$1,098,342, a \$8,400 gain over January, 1968.

► **Qantas Airways** (Melbourne) plans to re-imagine the Qantas City-Mines-Gowrie Madrid-Peru service that it has re-organized as a result of the recent strike. Five McDonnell Douglas aircraft have joined the fleet of short-haul and are planning an expansion program which also includes the purchase of additional Douglas DC-8-10s (from Standard Aviations Systems, Abu Dhabi) with a stop by British Air Lines to service in service to Mexico City.

► **Northeast Airlines** reports a January net income of \$31,042, the first such favorable income since 1946 according to the airline. Operating revenues were \$10,303,717, up 47.1% from January, 1968, and operating expenses of \$9,791,159, up 11.1% above last January.

► **Pan American World Airways** will begin a cargo service on its transpacific route from San Francisco to Manila on April 1 with Douglas DC-4 aircraft. Pan American who plans another service from San Francisco to Tokyo on a code-share basis passenger-cargo basis.

► **Twa** (Trans World Airlines), a supplemental contract has been issued from the West Coast to Hawaii of \$40,120 for a one-way trip on off season flights. The carrier will still hold its regular 559 fare during the season. At present, certified fares have a \$116 one-way fare on 15-day advance ticket and \$133 regular round fare.

► **Twa Texas Airways** posted a net profit of \$184,317 during 1968.

AIRLINE OBSERVER

► **Airline** between during January declined slightly below the passenger traffic carried the previous January, primarily because of the strike against Eastern and American Airlines. Revenue passenger miles dropped 0.9%, an improvement over December when the strike reduced 15%. Passenger load factor for the industry in January stood at 68.37%, a 1.42% improvement over January, 1968.

► **Lack** for an agreement between Western Air Lines and Allis Division of General Motors for the lease of 54 million worth of turboprop engines to power the carrier's fleet of nine Lockheed Electras.

► **Austrian** press, which regularly reports many major commercial and military plane crashes in the U.S., sometimes lists out publications for popular discontent put out by itself. The newspaper *Seewelt* Austria, offered copies of the Red Air Force, which states that "452 collisions involving passenger planes took place in the U.S. during a period of only five months last year." It added that "4,112 passengers perished" in these mid-air crashes. Figures cited apparently include passengers on planes involved in non-military. Soviets presumably make no distinction between persons killed in death and those actually killed.

► **Wright** for new purchases by Australian offices of Fokker Friendship and Sudavia Viscount 800 turboprop transports. Australian government is determined to meet strong pressure by the carriers for authorization to place additional orders for Lockheed Heron turboprops but apparently will allow the purchase of the Dutch and British aircraft.

► **American Airlines** has revised its seat configuration on the Boeing 707-300 jet transports to increase the number of flat-seat seats. Originally, the plane carried 412 seats divided equally between first class and tourist. Now 56 seats are designated first class and the coach section contains 35 seats.

► **De Havilland** Comet 4 transports have flown 28,200 hrs to date and have operated a total of 11 million miles. Comet 4 is in service on British Overseas Airways Corp. North Atlantic routes has logged 1,360 flying hours. BOAC plans to introduce the Comet 4 on its London-Tokyo route April 3.

► **Civil Aerostatics** Board hearing on the equipment lease agreement between TWA American and National Airlines has been postponed from Mar. 9 to May 15 because all evidence requested from National, Kansas and Northwest by the Board hearing examiner had not been submitted at the appointed time.

► **Lake Central Airlines** has completed its \$1 million financing program in a result of a \$750,000 bank loan secured by a chattel mortgage on the company's aircraft, engines and spare parts. In December, the first phase of the program was completed with the sale of \$300,000, 6% convertible sub-subordinated debentures.

► **O. K. Airline**, a leading Soviet transport designer, will soon be attempting to operate planes and participate in the revision of international civil aviation aircraft standards during the USSR's new Seven Year Plan. O. K. Airline has been selected to offend Soviet customers for the performance of its last two turboprop powered transport aircraft, the two-engined An-4 and the four engined An-10.

► **Philippine** government has terminated 15-year-old bilateral air agreements with the U.S. Government officials say termination came after the somewhat attempt to renew the 1946 pact to adjust what Manila calls unacceptable treatment of radio rights. Far East observers fear negotiations will be drawn-out and difficult because of present strained relations between the two countries.

► **Air Conditioning Committee** report of "U.S. policy concerning the disposal of passenger aircraft to be applied by turboprop and turbjet" assault will be released early this week.



Convair 880 turboprop transport, now undergoing flight testing at Jim Davis, Calif., will carry 80 passengers in first-class configuration.

Convair 880 Jet Transport Enters Flight Tests



Intercontinental version (not yet 100%) of the Convair 880 will have 4,210 mi range. The four General Electric CJ-853 turbojet engines are conventional versions of military J76. Engines are fitted with duct-type wind screens with blunt nosecones placed



Another Convair 880 currently is undergoing proof load testing on the ground; calibrating fairings will be pressurized under water



Transport, shown in "City" configuration, has a maximum takeoff weight of 19,000 lb. At its maximum day cruise speed of Mach .80,

A NEW ERA IN JET POWER



THE ROLLS-ROYCE CONWAY BY-PASS JET ENGINE

has now been granted a full certificate of airworthiness by the Air Registration Board at a minimum rating of 18,000 lb. thrust.

ROLLS-ROYCE EXPERIENCE IN THE AIRLINE OPERATION OF GAS TURBINES IS UNIQUE



THE DART

—the first, and for four years the only prop-jet in airline service has flown over 6,000,000 hours. The Dart is currently operating at overhaul lives of up to 2,300 hours.



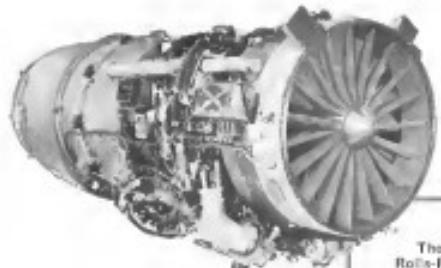
THE TYNE

—most advanced prop-jet engine, is due to enter service in 1960 at ratings of 4,885, 6,025 and 8,730 n.h.p. It has a specific fuel consumption comparable with the latest compound piston engines.



THE AVON

—the first turbo jet on the North Atlantic route, and now in daily service, began scheduled operations with an approved overhaul life of 1,000 hours.



DEVELOPED
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EXPERIENCE

The by-pass principle which Rolls-Royce have proved in the Conway engine is now accepted as the correct formula for all jet transport and for certain military applications.

The new RB.148 family of by-pass jet engines is based on seven years' development experience of the by-pass principle gained with the Conway and on six years' operation of other gas turbine engines in airline service. The first of this series has already been chosen to power the new British European Airways medium range jet airliner.

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AERO ENGINES • MOTOR CARS • DIESEL AND GASOLINE ENGINES • ROCKET MOTORS • NUCLEAR PROPULSION

Airline Traffic—Year End, 1958

	Revenue Passengers	Revenue Passenger Miles (Millions)	Used Tons	M. S. Mail	Express	Freight	Total Revenue Passenger Miles	% Increase in Revenue in Passenger Tons-Miles	
DOMESTIC TRUNK									
Aeromexico	7,208,330	1,756,561	80,1	21,846,540	5,467,703	91,172,471	954,494,769	12.1	
Delta	9,151,360	210,342	80,1	2,014,140	2,020,809	4,592,472	101,155,872	10.6	
Douglas	3,231,323	1,414,200	80,1	1,000,000	1,000,000	1,000,000	3,000,000	10.6	
Eastern	1,355,223	1,201,449	95,2	1,857,565	3,625,836	1,168,231	44,283,955	52.7	
Delta	3,393,284	1,488,038	80,2	3,380,410	3,389,001	19,086,954	954,956,311	11.4	
Eastern	6,194,041	5,132,473	80,29	1,818,320	4,384,714	12,671,375	20,149,771	48.1	
Northwest	1,249,400	1,149,200	80,2	1,249,400	1,249,400	1,249,400	3,748,400	42.7	
Southwest	1,075,201	1,059,213	80,4	1,057,376	572,493	1,174,957	41,995,083	31.3	
Trans World	1,662,264	1,231,246	80,4	2,077,179	2,426,375	11,123,490	76,340,590	49.0	
United	4,494,359	5,670,819	80,4	12,856,826	7,264,364	20,107,371	251,107,211	50.9	
Western	4,474,449	4,474,449	80,4	8,074,449	11,264,449	16,484,159	35,822,054	37.9	
Alaska	152,221	256,711	74,7	2,195,114	739,681	2,361,579	51,736,924	41.4	
INTERCONTINENTAL									
Aeroflot	120,355	111,309	22,8	113,364	8,311	3,211,128	18,426,316	34.0	
Brussels	66,438	81,702	44,8	150,249	1,081,261	11,081,205	44,27		
Canadian-Airline	262,421	12,478	80,8	17,070	49,276	1,719,445	44,8		
Egypt	67,188	46,010	80,8	1,000,000	1,000,000	1,000,000	44.8		
France	1,020,229	1,020,229	80,75	919,836	2,211,207	41,264,411	21.71		
Germany	92,228	11,154	44,9	1,000,000	1,000,000	1,000,000	44.9		
Mexico	102,228	102,228	80,9	119,303	81,872	80,643	2,104,126	44.9	
Switzerland	146,556	215,601	80,9	121,107,601	201,119	2,316,727	38,807,294	44.9	
Peru	Pan American								
Aerolineas	43,016	48,271	16,8	376,319	1,160,431	7,381,020	32.1		
Airline	1,100,251	1,242,053	44,8	16,171,261	29,375,000	122,288,146	39.9		
Latin American	1,116,114	1,116,114	44,8	1,000,000	2,211,207	17,211,207	39.9		
Pacific	265,445	265,445	44,8	1,457,517	95,232	166,534,327	44.9		
Passenger	137,799	145,201	50,4	808,649	6,121,631	30,845,119	42.1		
Race	South Caribbean								
Trans World	110,369	195,793	50,4	10,164,303	10,706,044	110,731,100	44.9		
U.S.A.	2,207	740	20,4	1,000,000	1,000,000	1,000,000	44.9		
United	161,179	221,201	44,3	1,072,360	1,411,169	28,293,890	39.8		
Western	17,176	16,703	44,3	1,000,000	6,474,449	3,856,128	34.3		
LOCAL AIRLINES									
All-Alaska	475,400	86,194	47,3	120,350	226,621	225,279	6,438,754	40.4	
Blue	160,384	42,734	46,6	44,112	31,628	73,112	4,238,218	40.7	
Central	150,390	38,873	94,6	46,341	34,081	102,341	2,246,320	30.6	
Frontier	221,723	42,270	48,3	230,449	199,204	870,546	2,946,309	54.1	
Great Northern	145,740	42,270	48,3	230,449	199,204	870,546	2,946,309	54.1	
Hawaiian	450,740	47,261	50,4	43,027	148,716	179,801	8,271,279	50.1	
Hawaiian Central	746,476	125,531	66,6	303,140	406,479	10,219,316	10,219,316	40.2	
Delta	425,792	72,272	48,7	191,416	219,307	10,435	5,646,809	40.7	
Delta	425,792	72,272	48,7	191,416	219,307	10,435	5,646,809	40.7	
Midwest	142,891	94,448	48,3	125,816	148,508	123,432	8,736,374	32.1	
Southern	122,534	41,816	39,8	71,446	130,363	91,403	4,340,898	38.8	
Trans-Texas	145,435	54,234	39,7	106,556	101,458	101,458	3,481,864	38.8	
West Coast	248,431	68,320	47,7	36,199	30,941	194,366	4,884,321	41.7	
HAWAIIAN									
United	400,434	86,045	45,8	37,179	1,000,000	5,182,258	32.4		
Trans-Pacific	100,362	94,241	50,8	5,171	1,000,000	5,076,349	34.3		
CARIBBEAN LINES									
Caribbean Helicopter	100,134	1,799	39,5	17,414	1,000,000	256,317	1,000,000	38.0	
Caribbean Airways	21,445	1,151,2	32,1	46,000	32,327	140,233	140,233	38.0	
New York Airways	90,114	1,261	44,8	17,420	11,351	4,137	50,816,812	44.8	
ALASKA LINES									
Alaska Airlines	72,479	20,464	46,4	482,367	26,809	3,726,321	7,458,023	42.0	
Alaska Central	57,464	4,419	41,6	44,334	65,344	4,247,649	44.9		
Crater	11,444	5,157	43,3	49,250	203,796	485,636	44.9		
Elbe	50,321	3,108	38,8	34,209	28,522	286,207	31,745,207	44.9	
Northwest Central	40,321	4,108	38,8	34,209	28,522	1,129,616	1,129,616	44.9	
Pacific Northwest	111,471	114,195	36,8	34,209,351	48,384	3,281,413	16,359,354	44.8	
Trans-Alaska	12,743	10,171	41,8	1,000,000	7,777,234	3,281,803	10,171,000	44.8	
West Alaska	20,087	11,426	33,8	337,124	2,107,238	3,790,121	33,8		

* Not available.
 Compiled by AIRLINE WEEK from airline reports to the Civil Aeronautics Board.



OPERATION OILIFT

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Alouette's equipment is the first jet-powered helicopter service in Canada. While still new in Alouette's rapidly expanding services, Alouette's bold and dangerous mission.

A Gleaming freighter, dangerously low on fuel, had been ice-locked for days in the St. Lawrence River. Even if an air-tractor could have gotten through, the nearest refueling site was 100 miles away. Alouette came to the rescue. Carrying 1,000 pounds of oil each trip, Alouette deftly delivered its cargo. Nothing stopped Alouette — sonic, ionospheric or solar variability, nor a half-inch of ice on the blades. Maximum pitch was no more than 125 degrees. In 11 below-zero weather all starts were immediate, and the operations remained normal throughout.

In Alouette's many activities — power line construction work, patrols, hydrographic surveys, and freight and passenger charter — Alouette has proven its all-purpose dependability in all weather.

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REPUBLIC AVIATION CORPORATION
 HELICOPTER DIVISION
 Farmingdale, Long Island, N.Y.

AERONAUTICAL ENGINEERING



HAWKER SIDDELEY PAGE VIK. 2 Victor bomber utilizes canard wing planform. Ram air scoops on aft fuselage provide equipment cooling air.

Sandwich Panels Cut Weight in Victor

By John Tostoff

London—Extinction of spot welded sandwich construction in wing leading edges, spar webs, fin and tail plane are saving valuable weight using conventional rad boltof joints of the Hawker Siddeley Victor bomber.

These aspects include high-efficiency transport wing joints in the undercarriage fairings, tension bolts joined in line with the instead of the panel cross section.

Sandwich construction plays a major part in the aircraft's low structural weight claimed for the Victor and its exceptional aeroplane stability and manoeuvrability, as its coded "constant" wing configuration.

Another unique feature is the extensive use of magnesium-alloy extrusions for detailed components. Titanium in the rivets over the engine bay and in some fuselage areas 250 lb.

Canted features reduce the use of skin layers in the operation of aircraft maintenance, which may assist the cost of maintenance to be kept within budget constraints.

According to K. R. Ober, design chief engineer at Hawker Siddeley Structural Efficiency Division, the Hawker Siddeley construction over a basic cantilevered airframe has closely packed corrugations in the direction of the principal load-bearing surfaces with the outer skin. These cantilever ribs to load, it evenly divides the section.

Sandwich skin panels used in the

MAN WITH A MISSION ...AND A MESSAGE

From the year ahead, "missions" of Space will come by message transmitted by man and by the machine instruments which will make them truly not accidents—almost impossible—Space events will be symbolically interpreted.

That is the mission you're missing. Through the few men in Space will have ventured into a region darkness by ages of time, the path behind him will be flooded with light . . . a light that focuses the message to the sensitive equipment below. That illuminating knowledge will light the way deeper—and deeper—into the darkness that still lies ahead.



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STRUCTURAL rigidity is emphasized in this view of Victor at top of a loop.

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Components undergoing vibration testing in our Leach Product Reliability Center include: strain gages, transducers, and electrical tests, including measurement of coil resistance and shorting of pickup and thermal sensors, dielectric characteristics, and insulation drop-across tests.

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RELAY DIVISION...LEACH CORPORATION

1815 AVALON BOULEVARD, LOS ANGELES 3

DISTRICT OFFICES AND FIELD REPRESENTATIVES IN PRINCIPAL CITIES OF U.S. AND CANADA
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The King of Air Fighters

(Continued from Inside Back Cover)

thousand feet and headed for home. A flight commander from Squadron 74 had just made the size of one of his pilots by drawing the enemy on to himself.

Such a case was British Edward (Mick) Mannock—an unpredictable fighter, a cool, calculating technician, the greatest fighter pilot of World War I. This sturdy patriot was accepted by the Royal Flying Corps despite a bad left eye and the bandaging of one eye, for Mannock was 70 when he arrived in France early in 1917 for assignment to a fighter squadron.

An Irishman who had been born on the wrong side of the tracks, Mannock served in the British Army for two full years of trench warfare in the Middle East. He served in the ambulance corps and with the engineers before being transferred to the R.F.C.

Unfortunately, he was neither a natural flier nor a good shot. Both took practice, and all it was two months before Mannock shot down his first German. He proceeded, cautiously at first—to the chagrin of his comrades—but within three weeks he bagged five more enemy planes.

Mannock scored the majority of his 75 victories in an S.E. 5 in S.E. 5a, the successor of the R.F.C.'s high-altitude air defense. The British-built S.E. 5 was famous for its maneuverability. Originally powered by a 150-hp Hispano-Suiza engine, its maximum speed was 119 mph at 6,700 feet and 96 mph at 15,000 feet. One Vickers machine gun had been through the pips, and a Lewis gun could be swiveling free for top wing if shoot opened. The plane was as easy to handle as the Sorghum Corral was difficult, but it couldn't match the Canadair for maneuverability. First production models were delivered about the time Mannock arrived in France.

During the latter part of 1917, Mannock was averaging a victory a day in



(Continued)



his S.E. 5. Before the year ended, he had 55 confirmed kills and was a flight commander. It was as a flight commander that Mannock added to the luster of his name. The impulsive air fighter was equally great as a flight leader. Although he was protective of his young pilots, Mannock had an open mind with the shortcomings of the more experienced men under his command.

The year 1917 was the year of heroes. Mannock became the No. 1 air fighter of the Royal Flying Corps—and his only fear was death by fire. He claimed a pistol with which to end his own life in each plane he sat after Mannock never had a chance to use the gun.

Late in June, 1918, Mannock was dogfighting. In following an enemy plane down to confirm the kill, he flew too low and was killed by a German cavalryman's bullet. Shortly afterward, his name accepted, Mick Mannock's Victoria Cross from the hand of the King of England.

Heritage of the Air

One of the most inspiring chapters in the history of flight is the story of the men and flying machines of World War I. It is a highly personalized story of heroism—of the wood, wire and leather that converted transports to fighters.

From the apes-took-their-first-walking-ganglion era to the space age, the Leach Corporation has served aviation with active components of unsurpassed reliability. Because it shares the many fine traditions of aviation, Leach is proud to present the Heritage of the Air Series.

For Product Advancements...

Color prints of the cover illustration of Mick Mannock's S.E. 5 and other World War I planes are available for mailing. Request a set of these colorized prints—complete with scale drawings and specifications—by addressing requests on company letterhead to Heritage of the Air, Leach Corp., 38435 Seura Rd., Compton, Calif.



SNYDERSON

NEXT TIME...
LOOK TO LEACH/INET
FOR PRECISE GROUND POWER

The INET 400 cycle ground power unit was designed for the A-10. The unit operates in parallel with the aircraft's power sources and provides remote control regulation. Frequency regulation is ± 0.05 . With load load equal to a third of rated output, frequency recovers to ± 0.015 in 0.15 seconds. Voltage regulation is ± 0.05 with recovery time at 0.00 seconds.

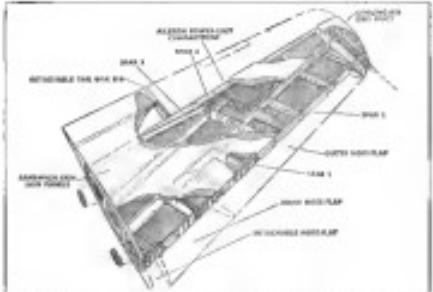


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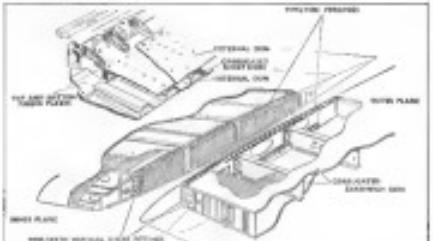
LOOK TO LEACH

INET DIVISION...LEACH CORPORATION

1845 BURBANK ROAD, COMPTON, CALIFORNIA



SANDWICH skin construction two quarts in the Vought's primary structure, elsewhere in the secondary structure.



DRAWING illustrates how pipe joint leakage seals locate the tension bolts in contrast of the panel sections. Flange plates are detailed at top left.

head tension bolts located between the legs, and in the main plane at the center of the sandwich cross-section.

Virtually all of the youth is covered by engagement of dog teeth fittings protecting front and rear spar webs. Face and side shear loads are reacted by the bolts.

Secondary structure, all of the multiple former boxes, has a spot-welded case skin with corrugated sheet stiffening but no outer skin. Using a comparatively thin outer skin with the corrugated strength chordwise reduces the spar webs.

The arrangement allows the secondary structure to follow load distribution of the primary structure without reflecting spurious loads, and avoids development of permanent shear waves which are characteristic of conventional skin-flange combinations in stressed skin structure.

side characteristics. Usage, load-skin characteristics of the wing joints have been proved in structural tests. These tests have shown that a crack, which always starts at the wing joint in the outer skin of the sandwich where it can easily be detected, propagates more or very slow.

This crack location is due to the fact that the outer skin, being spot-welded, is stiffer than the inner skin and therefore collects some load. It is also free from the residual stress.

During the conjugated case span wise between webs is another tensile feature. It looks much propagation is one-half joint width, and failure of a case shows wedge collapse. Propagation strength of the wing is only 10% and we see a much smaller reduction in the fracture strength.

Skin Checks

Other useful features of the panel system is to show that the outer skin cracks always appear before resin cracking. Circle holes would be difficult to detect. At such spot these are complete pinholes panel joints.

The fuselage is largely conventional soft continuous longer and stronger but design is compensated by the very long bays down the center. A number of different extruded aluminum are added for strength.

Dimensionally limited by the deep wing fusion has resulted in the fuselage is compensated by placing the front fuselage floor, two associated longitudinals and the bottom wing skin off in the same horizontal plane.

The nose section consists of five precasted cabin which is attached to the fuselage at four points connected with the principal top and bottom longitudinal. Precasted sections is housed by the cabin floor, shell, and a rear spherical bulkhead. Equipment is contained in an adjacent compartment which is pressurized by ram air.

Republic SD-3 Drone Makes Initial Flight

Republic SD-3 combat surveillance drone, developed for U. S. Army Signal Corps and designated Skymaster, has completed first flight and evaluation tests. Roman numbered three has made four successful flights, including nuclear launch and recovery. SD-3 has interchangeable nose and EWW Aug. 15, p. 271 for photographs in infrared detection, radio or television. Unit weight less than 1,000 lb. is 15 ft. long and has wingspan of 11 ft., propulsive is a 140 hp Continental engine. Device is handled by a mobile trailer by two Aeron IX rocket motors.

FORGINGS for supersonic air compressors and turbines in specifications to meet the new highs in jet power

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 NEON



3. HIGH SW RATIO one of the most efficient of strength-structure terms is the high strength-to-weight ratio—described here as *sw*. It is often typical to find, in designing the superstructure of a ship, a prioritizing the strength of structural steel bars more than half the weight of these bars is wasted.



PART OF THE PICTURE

when Twigg makes the remarkable sandwich panel...

AIRCO INDUSTRIAL GAS SERVICE



2. "WORLD" FOR SUCCESS Swigg insists on refuting the second point by Cervini. It will be the most massive and easily argued section.

One such base of this stainless steel is responsible for developing by a paper-thin sheet of metal rolling mill. And here Africa is still at the earliest stages of this vast aluminum-rolling plant. All which may provide certain high-strength plates required for aircraft and railroad cars.

Blind witness file opened at Sheriff's Office 10/14/1991 1:00pm when SRO



2. IN THE EGG: Non-chemically altered eggs develop into plants that are constituted and aged faster. Conversely, germination time is lengthened when an egg is subjected to heat.



4. RELEASED IN ARIZON. In this unit, now placed in a stateless status, released in a banana. It was found in August 1944 at a temperature of 38.8°F. The dimensions of wings from outside wing membranes are given. Estimated weight of specimen not determined. Found in 1940. Aug. 1944.

After the heating cycle the pressure is released to -0.05°F with CO_2 , helium and nitrogen. The pressure controller is then released and the pH is read (4000-40000 ppm) using an E^{2} model controller.



9 EVER READY SUPPLY from these three bulk trailers, sulfur and hydrogen are processed directly into the twelfth heating programme at Novovoronezh, Russia. More than 1000000 tonnes of sulfur are sent to Uralia as a sulphuric acid product. Here they represent an income earning to Novosibirsk energy supply of natural thermal energy.

Manufacturers in aircraft and missiles, steel, electronics, chemicals, food processing and many other industries rely on Aeron for dependable supplies of high purity industrial gases.

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SECTION THREE

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As noted previously, information related to the Center's mission and activities is contained in the Center's Annual Report.

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NEW AVIATION PRODUCTS

Nisus Meter

Digital current source, designed to draw a 1,000 gm 5.5 rpm hydraulic pump on an aircraft, is available for hydraulic pump drives, pneumatic compressor drives, fuel using valves and internal rotation drives on both aircraft and missiles.

Model D-1000 motor operates at 28 volt dc and 40 amp, motor draws up to 1.6 kg at 2,000 rpm. Higher output speeds to 25,000 rpm are available by doubling the reduction gear box. Motor life on field use is in excess of 1,500 hr., the mean time to failure is 2,000 hr., the mean time to repair is 100 hr. Average operating temperature is 30°F. at altitude. Motors for higher ambient temperatures, 50°F. and 200°F. are available. Motors are available for missile applications.

Thomson Electric Co., 2800 S. Shaffer Ave., Los Angeles 23, Calif.

Aircraft Coffey Cup

Breathing cup designed for use aboard aircraft aircraft flights. Plastic cap has integrated lifting ring which detaches the liquid reservoir, thus reducing the chance of leakage.

Cup is designated Aero-Cup Model K500-1. It holds 10 oz. of liquid.

Robinson Aviation Inc., Teterboro, N. J.

Jet Oil Pressure Gage

Aircraft oil pressure transducer, designed for direct mounting to jet air gages, is capable of withstandng vibration to 2,000 cps. at 20 g.

Model 515 transducer is available for ranges of 0 to 60 psi and 0 to 160 psi. Transducer available for use with the transducer are available in sizes of 14 in.-diameter, 2 in.-diameter, and 6 in.

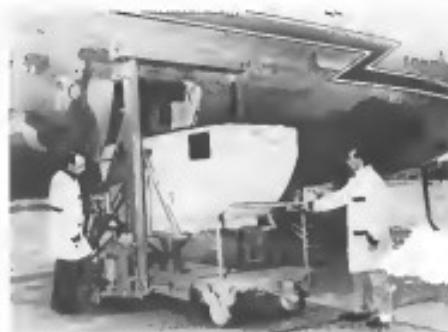


Gas Pressure Regulator

Regulator provides tank pressure ratio and pressure regulation in fuel, propellant storage of aircraft and missiles.

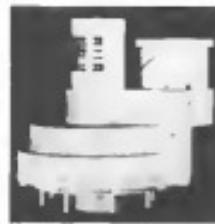
Principle regulator operates at 300- or -3 psi, over an inlet pressure range of from 3,000 to 400 psi and a flow demand range of 140 to 640 SCFM at pressures. Weight of the unit is 41 lb. and maximum diameter is 4 in. Dynamic response is less than 300 ms. Modified version of regulator can operate at 25 to 500 psi with flow rates to 1,000 SCFM at altitudes. Regulator operates between -65 and +225°F with helium, nitrogen, oxygen.

Rapides, Inc., 1400 Delavan Blk 1, Detroit 13, Mich.



American's Baggage Expeditor Used on Jets

American Airlines baggage expeditor system will be used in conjunction with the first Boeing 707-220 jet transport schedules. System includes six containers, each holding up to 15 bags, which are carried in the aircraft's forward compartment.



Constant Speed Drive

Differential type constant speed drive is used to combine accurate speed control, efficiency, low heat rejection and reliability.

Provides gear train in compact power package and a variable dipole



drive pump motor shaft or variable speed and power in response to a speed generator.

Input speed range of the 50 hp unit is 1,000 to 7,000 rpm, output speed of maximum of 6,000 rpm. Dynamic response is less than 300 ms. Modified version of constant speed control is 0 to -0.75% over a 2000 ft. temperature range, with efficiency to 97%. Transient response is 0.1 sec. maximum.

Rockwell-McGraw Div., Thiokol Chemical Corp., Denville, N. J.



NAPIER WINS THE FIRST CAA CERTIFICATION FOR CONVAIR JET-PROP CONVERSION!



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Jet-prop power for Convair... offers you the most direct solution to rising costs in air transportation.

30 ADDITIONAL YEARS OF PROFITABLE OPERATION

Convair, Ltd., a subsidiary of General Dynamics Corporation, now offers the jet-prop Convair/Cougar 540... in two versions. In Version A, you get a new jet-engine low aircraft powered by Napier 1500 horsepower gas turbine engines. In

Version B, your present Convair 540 is converted to jet-prop power by replacing its piston engines with the same Napier jet-turbine engines.

The economy and performance of both versions is identical.

Either version gives you the many advantages of jet-prop power. Either version offers a profitabilty span as long as that of the DC-3... which began in the mid-thirties and is still going strong.

The Convair/Cougar 540 is the latest development in the world-famous Convair series of 240-340-440 aircraft.

SHRINK OPERATING COSTS AND WIDE PROFIT MARGINS

When powered by Napier engines, the Convair/Cougar 540 aircraft operating costs drop from \$16 per mile to \$12 per mile... when your profits are made. Ground wear and debris decrease. There's less need for routine inspection and minor repairs. You also require less stockpiling of spare parts along the route.



Based on 2700 hours utilization and an average of 32 passengers. You can depreciate your investment in a Convair/Cougar 540 in as few as five years. The maintenance/protection capability more than pays for the cost.

In addition, the increased passenger utilization of jet-prop power will automatically result in a higher fare revenue factor.

MAXIMUM UTILIZATION OF YOUR CANADIAN/COUGLAR/CORVAIR 540

You can keep your Napier-powered Canadian/Cougar 540 in the air longer... where your profits are made. Ground wear and debris decrease. There's less need for routine inspection and minor repairs. You also require less stockpiling of spare parts along the route.





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Your Canadian/Convair 540 now covers more distance per hour. Speed increases by 50 mph. Time to cruise altitude decreases by 54%. Maximum payload ranges from 240 miles to 630 miles (with maximum). Jet-prop-powered Convair 540 can carry up to 46 passengers. The Canadian/Convair 540 now has a standard capacity of 46 passengers. In the Canadian/Convair 540 you have flexibility—from the de-luxe configuration of 46 passengers to a tourist configuration with 44 seats. Furthermore, you can tailor your seating plan to meet your specific needs.



MORE COMFORTABLE AIR TRAVEL
The Napier jet-prop reduces noise and vibration to a bare minimum—greatly enhancing passenger comfort and satisfaction.

SWIFTER AIR TRAVEL

With the increased speed, you can cut down travel time between stops. With less need for maintenance and servicing, you can minimize ground time.

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As the owner of a Napier-powered Canadian/Convair 540, you will get prompt, courteous and service facilities of Convair, a subsidiary of General Dynamics Corporation, and of Napier, a subsidiary of the English Electric Company. World-wide usage they will provide you with continuous analysis, correction, and prevention of service problems during the operating life of your Napier-powered Canadian/Convair 540.

**NOW FLY THE
JET-PROP
CANADAIR
CONVAIR 540**

**IN A
DEMONSTRATION**

Napier invites all airline operators, and executive and corporate aircraft operators, to fly the Canadian/Convair 540. The Napier jet-prop demonstration tour begins in March. Convair is using several Canadian/Convair 540's to schedule your flight, with the Napier Express, Inc., 100 DuPont Circle Building, Washington 2, D. C.





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North American introduces a
low-cost Space Age material:**

SPACE METAL

A WELDED STEEL SANDWICH

*Designers may
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experimental
quantities for
prototype development*

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HOW IT'S MADE: Production line machinery, developed by the Missile Division of North American Aviation, manufactures SPACEMETAL at the rate of 20 square feet per minute. The sandwich is now produced in 50-inch-wide panels, from type-304 stainless steel with a nominal gauge of 0.138 inches. Resistance welding eliminates excess weight of braze or adhesive materials.

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HOW TO GET IT: SPACEMETAL is available in experimental quantities to designers working on its unique properties for applications on missiles, space vehicles, aircraft, and related projects. Please write for complete information, specifying your requirements, to: Reservation Dept., 9000, Aerospace Division, North American Aviation, Inc., 12215 Lakewood Blvd., Downey, Calif.

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For replacement parts, there is no source like the original manufacturer!

The problem of bogus* parts is the aircraft engine parts market is becoming serious. Many and more counterfeited parts are flowing. They are difficult to detect. When they may look genuine they can cause trouble.

In addition, there are substitutes for quality. Play it safe. Make certain the replacement parts you use are genuine.

When a Pratt & Whitney Aircraft engine leaves our plant it's as good as we can make it. We'll do that way if properly serviced, using replacement parts that are exactly the same as original parts.

As the Flight Safety Foundation, Inc., points out in *The Problem of Bogus Parts*,* "Another reason for serious concern is that the airworthiness certificate of your aircraft may be suspended or revoked if bogus parts are used in its repair, overhaul or maintenance."

Protect yourself against trouble with bogus parts by dealing with the original manufacturer, his authorized distributor or licensee, or recognized, reputable overhaul or maintenance agencies.

*"The Problem of Bogus Parts," published by Flight Safety Foundation, Inc. A free copy of this informative booklet may be obtained by writing to Pratt & Whitney Aircraft, East Hartford, Connecticut, Service Division Manager.



PRATT & WHITNEY AIRCRAFT
East Hartford, Connecticut



CANADIAN PRATT & WHITNEY AIRCRAFT CO., LTD.
Longueuil, P.Q., Canada

In 1959, however, this trend is still alive—
years after the warning.
This decision in 1959 of building toward
a better tomorrow is the logical finding of the
engineering development department.
It is just that 1959 is a point periodically
at which time, we have had to review certain
of the engineering developments of the past 10 years.
In 1959, the decision was made that 1959
would be concerned for building 1964 1965
aircraft. This year has been very experimental
and developmental. It has been a period of the
dimensional addressed—the overall research
and development activities.

Engineering Development

Aircraft engineering development has been
more productive this past year than during
the last two years. Research and development
activities have been more active than ever.
Canadian aircraft studies have taken
place both internally and at a number of joint
designs the world over.

During 1959-60, the Air Force—particularly
the Strategic Air Command—has been the
primary organization to make the AFM development effort
in the search of a weapon system. It
was decided that the first aircraft to be built
of the new GRUMMAN F-102A (1961) that
of some money was needed to get the pro-
gram off the ground. The decision was
to prove that the project was worth
the trouble in developing, when there
was no money or equipment available.

This effort has been extremely suc-
cessful. In 1959-60, the AFM development effort
that various industry personnel, aircraft
and aircraft manufacturers have been
able to prove that the project is feasible
and that the AFM development effort
is the best way to develop the aircraft.

Since 1959, the AFM development effort
has been more successful than ever.

The AFM development effort is now
in the process of a stage which is ready to
present to a broader base. It is the AFM
development effort that is the best way to
develop the aircraft. So there are
the reasons why the development is necessary.

In today's environment, I feel the im-
portance that the AFM development effort
is the best way to develop the aircraft.
The AFM development effort is the best way
to develop the aircraft. The AFM development
effort is the best way to develop the aircraft.

Holley's strength lies in the constant approach
of the AFM development effort. We are working
on the solid performance theory to develop
the aircraft. As that this development work
was done, we are working on the solid performance
theory to develop the aircraft. We are just
beginning to see where and how well will
this approach work out. The results will
be in four years.

The AFM development effort is the best way to
develop the aircraft.

Capacity in Depth

When I say we are able to present
a broad range of products in all areas
of aviation working on the technology, I
am talking about a balanced and complete
range of products. We are able to design
manufacture engines and aircraft compo-
nents—air heated air, a complete line of fuel
systems, aircraft accessories, aircraft
engines, aircraft components and
aircraft accessories.

The most important product is the one
that the aircraft needs.



When CONTROL cannot be a question of degree . . .

Racing engine control believed impossible
only a few years ago is now the
expected, not only in modern aircraft
and missiles, but also in today's superso-
lidies and trijets. And, this absolute ac-
curacy is demanded under temperature,
pressure, and power conditions found,
usually, only in laboratories. Temperature
variations alone of -10°F to +100°F require
design steps to provide self-temperature

control. More, these exacting re-
quirements must be designed for over-
designed standards of size and weight.
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pioneered such developments as lower
intake boost, free flow carburetors and
fuel control systems for jet engines that save one-third the weight,
one-fourth the space. That's why two
generations of Americans on the move
have come to depend on Holley products.

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CARBURETORS AND AIRPORT EQUIPMENT

Pacific Range to Play Big Tracking Role

By Robert Hawkins

Los Angeles—Agencies with missile and satellite tracking capabilities can be expected to merge them into a single global tracking net before the beginning of the year, said Vice Adm. James J. Kelly, Pacific Missile Range official here.

Under the present arrangement, some agencies have their own specialized tracking nets. This is becoming unacceptable because it causes unnecessary costs and wastes space and missile apogee area.

Pacific Missile Range will be holding for a large part of the world wide retransmission job with mobile and shipboard equipment as well as fixed tracking and telemetry stations in California and Hawaii.

Pacific Missile Range is assigned the job of providing range services for all

projects launching long-range missiles and satellites from the West Coast as well as the job of operating the old test range and related range of Naval Missile Test Center, Pt. Mugu. Facilities which are part of Pacific Missile Range include Mags, Naval Missile Facility Pt. Argus, instrumentation at San Nicolas Island, 90-ft dish antenna at Malibu, Wobbies and Emerald. Distant shore stations are administered from an advanced base at Kurehama, Okinawa, Yokosuka AFB, adjacent to Argus, is not part of the range. It is a training base and a vertical launch site of the Fast Ballistic Missile Division, Strategic Air Command. Low-priority missile shots from Vandenberg get Pacific range support upon request and are coordinated with other activities in the neighborhood by Pacific Missile Range.

The range is not expected to achieve its full growth for 15 years, and the first orbit in that time should account about \$4 billion, of which half would be spent in the first five years. Expansion plans include extension of the test range from an area of 150 mi. x 270 mi. to a broad 500 mi. wide and 1,500 mi. long. This will give room to the east and just off shore. It would also add a new range area for the big hydrogen atom bombs which probably be useful for development and test flights of space. High long range resolution because of the ease with which instrumentation could be placed along the coast. It would also be handy for recovery of satellites. The Fiscal 1960 budget will expand the test range to an area of 250 mi. x 500 mi. on the present 150 mi. x 250 mi. dimensions.

An area of about 1,500 mi. from the pole is a potential IRBM target area for the range's ships and ICBM targets for the range's land-based Wobbies and Emerald. Plans also for extension of the ICBM range in impact area over 30,000 mi. away in the Polaris Ocean. Mobility is a obvious characteristic of the range's instrumentation advantage as it is taken of the facilities available in the vicinity of the range. Isolated range between Pt. Mugu and the Army's Argonne proving ground to Ulithi which was used during China-Vietnam Regular program was instrumental enough with track and data link facilities prior to being transferred to the range to become an important project. Interim range will be re-opened in about a year and a half. Long range planning calls for 12 range sites to cover the missile range and satellite projects being fired from Vandenberg and Argus. The sites will provide tracking, telemetry, recovery facilities etc. They will belong to civilian operating contractors or will be obtained from Military Sea Transport Service. Navy considers the use of fleet units for range instrumentation.

At present there is one range ship operating and another is being acquired in fiscal 1963. The one operating is USNS Pacific Joe E. Meany. It is manned by a civil service crew of Military Sea Transport Service and is permanently assigned to Pacific Missile Range. Instrumentation in Joe E. Meany is operated by Lockheed under an Air Force-administered Advanced Research Projects Agency contract to support the Discoverer-Sentinel WS-117L program now launching polar sat-

ellites from Vandenberg. On the December 1 launch, Joe E. Meany was situated 900 mi. down range.

The new ship, which is estimated will be a modified VME 2 victory ship, it will cost about \$3 million and will take about two years to convert it into a range ship. USS Nitro Sound, the only ship now equipped to launch large rockets is based at nearby Port Hueneme Naval yard and is sometimes used by Pacific Missile Range as a command ship.

Pacific Missile Range is not offering precise down range tracking because the equipment is not available and so the range has been assigned to the Army which would make it necessary. Missile impact locator stations (MILS) are being installed at Midway, Wake, Enderbury and other Pacific Islands as a check on accuracy. The MILS use World War II SONAR underwater sonar ranging technique to locate impact. An explosive charge in the missile would be detonated at a depth of about 2,000 ft. It which is opposite exactly the level of the depressed propagation channel in the ocean. This is being set up gradually and a permanent system of about 10 of the original 21 initial stations provides it by the print of deployment.

Pacific Missile Range has agreed to supply the instrumentation for the newly disclosed equatorial satellite launching range and is now seeking a location as the proposed launch site and most of the program would probably be run by National Aeronautics and Space Administration. No launch site has been selected or planning is in progress.

It would be out of a country of islands or it might even be possible to launch from a ship.

It has not been definitely established that there is a need for an equatorial satellite launch site. There are two important advantages to be had from the equatorial orbit. The orbit is geostationary so that the satellite goes over the same station on every pass. That means economy for tracked satellites and only below the number of stations needed to get complete coverage.

The other advantage is that the plane of the equator slopes in within 210 deg. of the plane of the ecliptic, near which all the planes of the sun's elliptical orbits are located. Therefore, interplanetary orbits would also be in the plane of the ecliptic. If the number of programs requiring equatorial orbits is small, it would prove more economical to accept the performance sacrifice, necessary to maneuver from the inclined orbit into the equatorial one. This road cast justified by as much as 90%.

Most of the first few uses for satellites such as weather mapping and weather

AVIATION WEEK, March 16, 1959



DISCOVERER 1 launching from Vandenberg AFB over the Pacific Missile Range (WV)

Max R. S. SHI (UPI) (UPI) (UPI)

part in Pacific Missile Range planning may offer first or early coverage of either earth or 12 hr. Since it is the only established range from which a polar satellite can be safely launched, Pacific Missile Range will probably have an important role in development of these satellites despite the fact that no previous role in the low polar orbit is supposed to be running.

As development losses, Argus and Mags also offer advantages of safety and economy since they have been population centers and are surrounded by ranges of hills which would locate blast from nuclear warheads and the like 15 to 250 miles. In these chemical boosters now being discussed, low burns during development and training should be taken into account since high rate flight duration and single trip life of a whole or satellite never allow much flight test time to accumulate. Therefore double passes are likely to be made on the future.

Growth of Pt. Argus plays a large

role in Pacific Missile Range planning as the increased launch rate of many polar orbit satellites. It is the only land-based range in the region from which it will be possible in the near future to launch large satellites. It is located at a right angle corner of the California coast west of Santa Barbara and a big rocket launcher from there due over oceans but miles between the land and the South Pole.

Missile facilities at Argus are at

present incomplete. Funding and material funds taken up operating, costs and utilities are under construction and available for telemetry, range operations and communications are being prepared. Coverage has already been planned for pads in the first launch complex which is to be used by ARPA but for the next year nearly all range flights will be from the completed pads at Vandenberg.

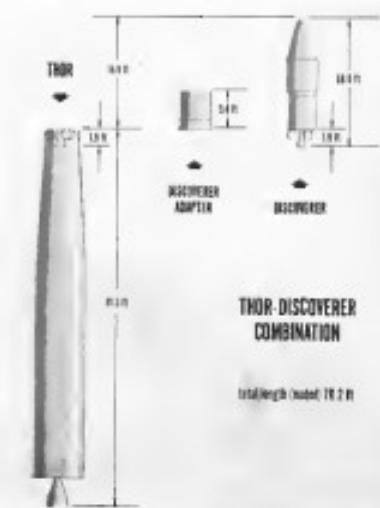
NASA is also reported to be interested in building a launch complex at

Argus but no definite decision has

been reached.

THOR-
DISCOVERER
COMBINATION

Total length (inches) 70.2 ft



OVER-AIA LENGTH of Discoverer 1 included a modified Douglas Thor and Lockheed satellite vehicle, at 70.2 ft. Satellite was the first to be launched from Pacific Missile Range.

AVIATION WEEK, March 16, 1959

64

67

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GLEAN aerodynamic design characteristics thereof of Captive Missile Test Track. Sled can carry 120 lb. payload at 2,700 mph.

Rocket Sled Achieves Mach 4.1 Speed

Holloman AFB—Velocity of Mach 4.1 was achieved at the Air Force Materials Development Center's 15,000-ft sled track shortly after its formal opening last month (AW Mar. 2, p. 25).

Two-stage motor-powered sled tested at a top speed of 4,530 feet per second, or 3,090 mph., in a test in

dramatic fashion went on the steel rollers on which the sled rides.

High-speed sled was first tested to about Mach .2 by an 8,190 lb.-thrust Captive rocket, and to its final velocity by a cluster of four Loki rockets. Although friction between the sled skippers and the rails is considerable, it

accounts for only a small fraction of the overall drag when the sled is traveling at supersonic speeds.

Sled track was constructed for testing of missile components, booster boosters, vibration tests, acceleration and wind-tunnel effects. In some cases complete missiles, such as boosters, have been given



AERIAL view of Gleam test sled shows vehicle hitting the track links. Triangular shaped ramp mounted below the sled lower photoflash units in the trough and drives it out via link rods and behind the sled after bringing it to a stop.



AVIATION WEEK, March 16, 1967

high-speed explosive tests on the track prior to flight.

The Holloman test extends for 15,000 ft over White Sands Proving Grounds. The two rails were forged cold in 10-ft sections and joined together in such a way so as to be smooth along their entire length. To prevent buckling at high temperatures, rails were thermal treated to relieve stress and then heat-treated to constant tension at temperature below 1,100°F. Total elongation due to heat treatment, over the entire length, is 3.5 ft at a temperature variation of 2,000°F.

Profile of track shows a rise of only one foot per thousand feet of length. Topography of the area is such that the track can be extended for an additional 50 miles.

Accelerations up to 10g's are possible and decelerations up to 15g's can be achieved through a water-braking system. Variations in deceleration are controlled by changing the depth of the water brake and altering the shape and draft of the trough beneath the sled. Water level is maintained by pumping down which levels in the trough contain them. The sled's draft is then inverted by the water, resulting in deceleration.

Programmed decelerations have been accurate to within 7%. "Radar" signals sent to the water brake make the sled resemble a driver home Gold Cup race.

According to Holloman officials, use of sled track facilities will result in considerable saving in testing of missile components. Tests generally will be considerably safer since flight can be subjected to an environment similar to actual flight conditions and reversed if desired for tests.

USAF Contracts

Following is a list of announced contracts for \$250,000 and over as released by Air Force Contracting offices:

AIR FORCE SYSTEMS COMMAND

Contractor: Boeing Co., Seattle, Wash.

Contract: Contract AF-33(67)-10000.

Description: Boeing Co., Seattle, Wash.

Amount: \$250,000.

Period: One year.

Project: AF-33(67)-10000.

Location: Seattle, Wash.

Object: AF-33(67)-10000.

Comments: AF-33(67)-10000.

Source: AF-33(67)-10000.

MANAGEMENT



USS SARFIELD (DD-871) from a bridge log (bowl) position on ASW operations off Key West, Fla. USN Ryerson is in foreground.

Fund Limit Sets Pace for ASW Progress

By Carl Stearns

Washington—Navy needs larger and more search forces plus a major breakthrough in detection techniques if it is to ensure effectively the defense of Soviet missile-bearing nuclear submarines. At the moment, progress for the first apparently is slight, and the timetable for the second appears largely dependent upon the availability of funds and effort.

Rear Adm Charles E. Winkler, submarine warfare academic executive in the Office of the Chief of Naval Operations, told a group attending a recent anti-submarine warfare symposium here that the time needed to achieve the necessary breakthrough

would largely "depend upon the budget."

Funds presently allocated by the Administration for ASW in the Fiscal 1960 defense budget fall slightly below those provided in Fiscal 1959 when Congress appropriated \$44 million above the original request in an effort to accelerate research and development programs.

Fiscal 1960 research and development funds, Adm Winkler said, will amount to approximately the same level as those of Fiscal 1959, reflecting the supplemental appropriation, but requests for shipbuilding funds are below those of the previous year. Winkler added, however, that "we find the economy means of achiev-

ing a breakthrough, we'll get the money."

Vice Adm Robert B. Price, deputy chief of naval operations for air, last fall in the Fiscal 1960 request for ASW research and development funds, called such a "meager amount of the total budget" "a misnomer."

Earlier, in referring to the overall ASW budget at a wide-area prepared speech at the symposium, Adm. Price said: "Most of us wonder if we are spending a reasonable amount of the national program on the vital problem of submarine warfare."

Other developments at the symposium, sponsored by the Navy League, were designed to emphasize Navy's need for better ASW weapons and techniques, included:

• U.S. has no adequate defense against the mobile, missile-launching submarine. Vice Adm. William G. Geiger, commander of the Atlantic Fleet's Anti-Submarine Defense Force, said: "... our opponent, the submarine, is going through a period of domestic development. ASW is trying to catch up. It is the old story of the offensive weapon getting a head start."

• Major breakthrough in detection has become imperative in view of the recently U.S. Navy plan to increase Soviet submarine launching and launching or holding missiles from the surface as well as sea. Adm. Price said the Navy needs a system that will permit detection "from the surface from 50 to 75 mi. down the sounder to a depth of 1,500 ft." This would permit an "efficiently cover the ocean against any class submarine."

• Sonar, which may have been extended by a factor of three since World



GRUMMAN S-2F Tracker makes run on USS Belafonte during ASW training.

Metallurgical Memo from General Electric



Why it sometimes pays to work in a vacuum

Metallurgical Products Department reports on how a G-E vacuum-melted alloy of exceptional purity speeded production of super-strong jet engine rings

"All American Welding difficult production problems are just part of the day's work. But fabrication of jet engine rings of a vacuum-melted alloy, one of the strongest materials available, proved to be especially difficult, and production slowed to a trickle," according to Charlie Miller, purchasing agent at The American Welding and Manufacturing Co., Warren, Ohio.

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because of their experience with this particular alloy. The Best 41® they supplied us proved to be exceptionally clean and was more easily formed and welded. We soon reworking production schedules."

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War II, often the best immediate potential for acquiring additional wings through sophistication of present systems. Some credibility, however, is gained by sound detection as it strikes the temperature limits of the air and by its limited capability for determining.

* Non-acoustic system, possibly some form of long range electroacoustic detection, probably will provide the best longrange answer. Standardization Division of General Dynamics Corp has a staff contract with the Office of Naval Research for development of such a technique.

* Acoustic system, an anti-submarine warfare tool shown a modest success during the past year, with a number of companies establishing their own funds to research and development programs in an effort to fit the Navy budget gaps and improve the state of the art. The official response has been noted that "in an unprecedented positive move, industry is putting its own money into elaborate research programs to develop the necessary equipment for an adequate anti-submarine force."

* Soviet submarine contacts have been made by the Navy from the Atlantic to the Pacific, reflecting the U.S. standard, but never within the transoceanic level, despite conflicting reports to the contrary. Navy says its "positive identification" of Soviet submarines has been made in this area since, under Navy acoustics, "positive identification" requires an actual visual observation of a surfaced vessel. Soviet submarine commanders apparently have orders to remain submerged at all costs while operating near the U.S. coast.

Options were decided among the top Navy officials attending the conference to be the revised design of the submarine and the problem weight of time before full-scale nuclear-powered submarine could make their appearance in operational service. There was general agreement with Adm. Cooper, however, that the "submarine crisis" threat is easing and it's coming fast.

Adm. Cooper added that "we give the Soviets credit for having operational anti-submarine missile launching submarines but we don't believe they have any operating operationalally . . . We think they could build up an operational force relatively fast."

Adm. Joseph Wright, commander of the U.S. Atlantic Fleet, said the submarine threat continues to increase though not yet in size to feel from the air. "I don't know how many missile submarines they have . . . but I assume that they do have them." He also added that there is "evidence" that the Soviets are modernizing on new types of submarines and that this explains the decline in the number

of Russian submersibles at sea from 450 last year to 180 at present. "We're saving and reasonably well established evidence that they are developing our anti-submarine programs at lightning speed, but we can't believe that they are working on Polaris-type submarine."

Capt. Richard E. Loring, division commander of the nuclear submarine Service and now attached to the Office of the Chief of Naval Operations, pointed to the Soviet emphasis on production of conventional submarines and added that, if the need for low-speed, low-cost, short and protracted cycle is inherent, "our imported, available submarine might prove to be quite produc-

tive." This view finds no ASW support since the problem is recognized as being more serious than Navy.

As an example, he cited one particular company which he said "has had a naval contract for years." Now, he added, "it has had 75 of its finest men working on anti-submarine research for the last nine months."

One concerned industry man cited his efforts at the conference to get the establishment of an ASW defense organization from Navy's public-relations chief but was told of the existing lack of effectiveness of the command and staff submarine detection and classification techniques.

Adm. Womble told a responsive group that "many companies have been

invited to submit proposals for the

problem involved in providing an effective ASW defense organization from Navy's public-relations chief but was told of the existing lack of effectiveness of the command and staff submarine detection and classification techniques.

Adm. Womble told a responsive group that "many companies have been

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Lack of adequate forces to cope with the Soviet submarine fleet, with its double threat as a strategic and tactical weapon, was recognized by Adm. Cooper, whose Atlantic command now has three special ASW defense and classified ASW techniques. Cooper, under NACA guidance will appear on a basis similar to that of the Air Research and Development Command's European office in Brussels (AW, June 9, 1958, p. 21).

"It appears that there are no such forces in the United States," says Mr. Pelegi. "The Navy may not reflect that, but has a little data on existing on to the problem since most of the Soviet submarine fleet has been in the Atlantic. I think that's why we got the point now, though, and the re-arming along pretty fast."

The need for large, available anti-submarine warfare forces also was emphasized by Adm. Womble, who termed ASW a "national problem" as well as a "Navy problem" and said that the Navy must be the ones to expand for the submarine (see "The most effective means of detection").

The problem is manageable only by refurbishing large forces involving expansion and acquisition of equipment and highly trained men."



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SOLAR SAILING Space travel with the sail of solar radiation pressure—an area of advanced research at Lockheed. Vehicle would employ a sail that would be raised and lowered in flight. The artist has depicted Magellan's ship "Tresfado" to symbolize man's great voyages of discovery.

Lockheed Missile Systems Division is engaged in all fields of missile and space technology—from concept to operation. Advanced research and development programs include—war in space; space communications, electronics; ionic propulsion, nuclear and solar propulsion; magnetohydrodynamics; computer development; seismography; flight sciences, materials and processes; human engineering; electromagnetic wave propagation and radiation; and operations research and analysis. The successful completion of programs such as these not only encompasses the sum of man's knowledge in many fields, but requires a bold and imaginative approach in areas where only theory now exists.

The Missile Systems Division programs reach far into the future. It is a rewarding future which none of outstanding talent and inquiring mind are invited to share. Write Research and Development Staff, Dept. C4-17, 562 W. El Camino Real, Sunnyvale, California, or 7701 Woodley Avenue, Van Nuys, California. For the convenience of those living in the East or Midwest, offices are maintained at Suite 745, 405 Lexington Avenue, New York 17, and at Suite 300, 840 N. Michigan Avenue, Chicago 11.

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AVIONICS



SEE system, developed by Sperry Gyroscope Co., induces side echoes by means of traveling wave tube amplifiers. Photo at left shows X-band system consisting of tube, power supply, transmitting and receiving antennas, and test indicators. X-band and L-band antenna rotators are shown at right. X-band receiving antenna is concave type; transmitting antenna is open-end, waveguide. L-band system employs broad-band dipole.

Radar Echo Enhancer Simulates Bombers

By James A. Fosse

Great Neck, N. Y.—Gyrocom, owned by Sperry Gyroscope Co., has announced radar echo enhancers for electronic counter-measure aircraft used on the Atlantic Missile Test Range, Cape Canaveral. These devices make it possible to radar target surfaces or ships from the smallest fighter to the largest Strategic Intercontinental bomber.

The description is advanced by means of a side echo enhancer, which is called SEE, developed by the Aerospace and Equipment Division of the Sperry Gyroscope Co.

SEE, standing for Sperry Radar Enhancer, is a receiver circuit that will take older radar response systems that basically function as a receiver and turn them into the first true receiver. The difference however, is that the portion of the transmitted signal is proportional to the power of the return signal of either the natural operating range of the traveling wave tube. When the gain of the receiver is set to provide a return signal equivalent to the echo echo from a target of specific size, the augmented radar echo returns are proportional to the desired target size at the target range in range limit of the radar.

In addition to target range applications, Sperry anticipates use of the SEE system for training of air defense personnel, radar controllers, and civil air traffic control. The system is not expected to compete with the ATC function for use in commercial aircraft but,

because of its claimed simplicity and low cost, the company expects it to find use in business type aircraft.

Development of the system began last in 1956, with feasibility tests being made in 1957, under company funds. Slightly different systems have been designed to operate at L-band, S-band and C-X band.

Use of the system at Cape Canaveral began with test flights conducted there last fall.

Sperry engineers say that the L-band systems being flown at the Cape have been operated successfully under actual combat conditions in X-10 and DC-30 planes, and North American F-100 aircrafts at altitudes above 30,000 feet and speeds approaching Mach 1. The engineers has operated vehicles without pressurization or thermal insulation.

Resonance ECM Equipment

The SEE system clearly resembles electronic countermeasures equipment using traveling wave tubes to intercept and jam microwave signals. Such countermeasures equipment, however, is more complex and more expensive, because the received signal must be processed before retransmission in some manner that will confuse or distract the enemy.

The traveling wave tube of the SEE system functions only as a modulator, with changes in radar range. This defines the side target echo series parameter of the standard side range capstan.

For a reflector that makes a constant series target echo, the angle of radiation must remain constant. As a result, beam-to-target sensitivity decreases, because power output is constant for any angle level above some minimum, causing unnecessary emission effects at varying radar range.

The tracking wave tube of the SEE system handles a very wide band microwave amplifier to which has been added an adjustable gain attenuator for a definite dynamic range of the output signal level. This level ranges from the input noise level to that required for target power requirements. The remaining power requirement is a power supply and an unmodulated microwave oscillator providing the desired optical control.

Operational Features

The operational features claimed for the SEE system of radar augmentation are:

- True area resolution is a function of active gain gain.

- Adjustable area simulation is local and spatial distribution through attenuation and antennas.

- Local operation for repeater, multiple station operation. Repeater stations obtain a change in target echo received by the fronttracking radar proportional to the simulated target area. In bistatic operation, the target echo received is a ratio using sensitive listening—such as the Bosochova—a proportionality to the simulated target area.

- Simultaneous multiple frequency operation.

- Overall system control by radio command or manual relay operation.

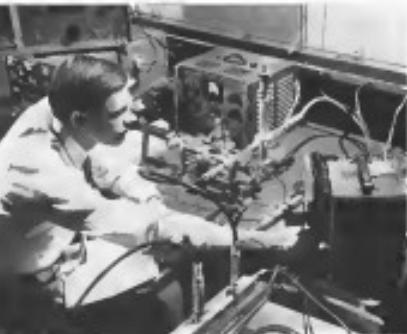
The attenuating power level of the system is set so that it will provide the limit of linear operation and therefore the limit of linear area simulation. In practice, this attenuating level is matched to the level at which the radar automatic gain control becomes non-linear because of signal limiting factors. For this reason, the important region for segmentations between attenuators and load is on the noise corner, where the signal and the receiver noise levels are competing. These nonlinear radar return charts usually cause noise generation at signal-to-noise levels of about 7.10 dB.

One disadvantage of conventional radar beams has not been compensated with the SEE antenna—that of double target returns. This occurs where the skin return from the aircraft is strong enough to appear on the radar's plan position indicator with the slightly deflected beam return. Delay between



Pioneer IV Tracked by GE

Segment from the Army's Pioneer IV satellite was recovered to a distance of 413,000 mi. at General Electric's space tracking facility at the end of a 100-mile leg of the test flight of its 10-ft parabolic Antares. Antares employs a wheel track with a 1.45-in. pitch for figure tracking at L-band with 100 kc bandwidth. Power frequency is X-band. Facilities (above) for engine assembly and test at GE's Henry Moseley Dept. and General Engineering Laboratory.



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annual and subcontracting of the negotiations return with the SEE contract is relatively small, Sperry engineers say, so that the two efforts are supplementary.

Production of SEE aircraft by Sperry to date has been slow; initial flight tests recently having gone to Boeing Airplane Co. for the Boeing test program at Cape Canaveral and use a X-band system by Ryan Aircraft and Co. for study as to its use with the Ryan Navaho drone. Additional X-band systems will be purchased by the Air Force for use at the Eglin Gulf Test Range in conjunction with testing of the new, long-range DM-900 missile under development.

One of the missions for the increasing interest in active radar reporting systems, according to Sperry, is the belief that passive reflectors cannot provide the echo discrimination required—either because of limited angular coverage, because of the very request for use with lower frequency radars, and because radar cannot be used.

Other companies that are believed to be active in this type of work are the International Telephone & Telegraph Laboratories and Transocean Aircraft Corp. ITT's Laboratories holds contracts both with Ryan and Boeing.

FILTER CENTER
 ■ ■ ■ ■ ■

► **Cosine Computer**: Payoff—Use of a cosine control computer in a Boeing 727 instead of improved cosine curve and direct response had consumption efficiency sufficient to permit a 9,000 lb. savings in auxiliary gross weight, resulting in flight range increase. The 9,000 cosine control computers was developed by Ohio Crayon Manufacturing Co. from program development by Massachusetts Institute of Technology. The computer can run in the Convair B-58 Program was sponsored by Wright Air Development Center's Flight Control Laboratories.

► **Selective Calling Evaluation**: Comparative flight evaluation of eight different types of air-ground selective calling systems revealed it would not at Wright Air Development Center. Following tests, the laboratory will draw up specifications for selective calling systems incorporating best features of each type for subsequent procurement. Systems must be suitable for use in high frequencies and low high-frequency bands, both single and double sideband type operation.

► **Signed on Dotted Line—Major contract award recently announced by various manufacturers include:**

► **International Business Machines Corp.**, White Plains Division, will provide ultrahigh speed digital computers to International Telephone & Telegraph Corp. for use in Strategic Air Command Control System which controls launching of its missiles.

► **Thompson Ramo-Wooldridge**, Paulsboro, has signed order for rental of its RW 300 digital computer to the Federal Aviation Agency. Computer will be used in simulation and studies of traffic control problems in FAA's Research and Development in Atlantic City health.

► **Smith Engineering Inc.**, 5500 80th Street, has signed a contract with the Signal Corps for AN/FVS-1 Silence Locating System which will be used to detect and locate atmospheric disturbances at long range to warn of formation of nuclear warhead conditions.

► **Hofman Electronics Corp.**, St. Louis, has contract from Navy Bureau of Personnel for modification and an improvement of AFM-21 mobile transmitters.

► **Bendix Instruments Inc.**, 5225 80th Street, Kansas City, has high-speed analog computer to be used in simulation of maneuverability of aircraft.

► **Seversky Electronic Products Inc.**, Fort Worth, has contracts totaling more than \$5 million, from Signal Corps for development and production of three additional MDR-1000 multistage digital computers.

► **General Electric Division, The Cobalt Co.**, Natick, Mass., 5219 80th Street, has Navy Bureau of Aero mechanics for production of ruggedized version of high gain multistage AFM-21 mobile communication systems, AFM-750/U.



Eight-Element Helices Recovered Pioneer IV Data

Tracking and telemetry signals from Pioneer IV, the Army's first probe fired on May 3, were received for the first day by General Electric's space vehicle tracking station near Schenectady, N.Y. Antennas for the facility is made up of eight helices which feed double-sided high frequency receivers. Facility is operated by engineers from GE's General Engineering Laboratory and Harry Diamond Dept.



B-26 CONVERSION for executives can be R. G. LeTourneau, Inc. Note in first view (bottom view) that has been installed in the cracked hatch cover to protect the pilot. The conversion has a square cabin window under the wing (see our view) and a square window off of the wing which also serves as an escape hatch.

LeTourneau to Offer B-26 Conversion

By Craig Lewis

Longview, Texas—R. G. LeTourneau, Inc., needs a growing diverse capability in the field of commercial aircraft aviation and service late at LeTourneau Air Center by offering business customers an executive version of the Douglas B-26.

LeTourneau's B-26 conversion program utilizes its own extensive operation of the World War II bomber as an executive transport. Company has converted three aircraft and still has two of those in its fleet. A fourth aircraft is in the U.S., as well as in West Africa and South America.

This conversion program is part of a growing aviation activity operated by a company that is basically a manufacturer of heavy equipment for construction, petroleum, logging and other

industries. LeTourneau's fixed base operations arm has developed gradually from the days set up to service the company's executive aircraft, and it now does a wide variety of overhead, maintenance and service jobs.

Weight Reduced

LeTourneau's B-26 conversion program utilizes no basic structural changes in the military version. It largely confined to removing armor and other non-essential military weight and to refining the basic airplane into a passenger configuration. LeTourneau refers to the large wing type of the military version as the "B-26."

After conversion, the B-26 has an empty weight of 22,000 lbs. and a gross weight of 37,000 lbs., providing a 15,000 lb. fuel load. Maximum speed is 400 mph and cruise speed is 315

mph, with the Pratt & Whitney R-2850-75 engines and Hamilton Standard propellers which are standard on the company's executive aircraft, and it now does a wide variety of overhead, maintenance and service jobs.

Absolute ceiling is 30,000 ft. and maximum ceiling is 25,000 ft. Normal flight ceiling of altitude lower than that but LeTourneau needs the capability in its new operation on order to fly over the Andes in South America. Since the aircraft is not pressurized, oxygen would be provided at each seat.

The company operates two different versions of its executive B-26. The long range version can fly 3,000 miles with a 45 minute stopover, and the shorter range airplane has a range of 2,100 miles with a one hour stopover. Both capacity of the military B-26 has been increased by adding tanks at the wings. Minimum range version carries 1,316 gal., and the longer range airplane, with

a tank in the fuselage center section, carries 1,700 gal. This is far according to the airplane's range. At the weight limit, the cabin is 18 ft. 4 in. long, 47 in. wide and 64 in. high. There are two seats across the back and two seats along one side. Each of these two side seats can be folded out to make a three-passenger couch or a high density configuration. With the fold down in the wing center section of the airplane range version, space is available for a two-passenger couch forward of the rear wing spar.

Since the B-26 is a high-winged airplane, the rear wing spar cuts directly through the fuselage and splits the fuselage area available for cabin use. LeTourneau has decided to accept this space penalty in order to retain the strength originally designed into the wing structure.

A passenger seat is also available in the cockpit forward of the ring. Both of the two LeTourneau aircraft retain the single pilot cockpit configuration of the military version, although the company expects to install a co-pilot manual station in future models. Very little technical change has been made in the interior area, although the floor, control, electrical and other systems have been covered with sophisticated paneling. B-26 can be equipped with cabin if a customer wants it.

Cabin Seats

The cabin is entered through a hinged door at the front while at the fuselage door makes the wing providing access to both the passenger cabin and the forward cockpit. The cockpit can also be entered through hatches which form the top of the rear fuselage section and the bottom section in the middle fuselage to protect the engine.

In continuing the military antibiotic LeTourneau cuts out unnecessary metal, leaves the floor on the old hump bay 449 5 in. to represent extra head room and moves the rear bulkhead back about 16 in. to increase cabin length. The fuselage is completely redesigned, and fuselage strength is maintained by increasing skin gauge where changes have been made in the military structure, according to W. D. Sherrill, manager of the aircraft division. The engines are mounted in each side, with the main starboard window also serving as an escape hatch.

Baggage is carried in a large compartment in front of the passenger cabin. An air conditioning system is off of the rear baggage compartment. Since can air is difficult to control at B-26 speeds the 14-foot atmosphere is mixed and heated completely by blowers, and they do so smoothly in the fuselage.

Cost of the converted B-26 can range



COCKPIT in the LeTourneau B-26 has the original single pilot cockpit. But LeTourneau expects to install a co-pilot station in future conversions.



REAR BAGGAGE compartment (left) is located in the aft cabin bulkhead. Air conditioning system is behind this baggage compartment. Baggage capacity is also provided in this rear compartment at right.



REAR WING SPAR runs through the rear bulkhead covered by wood paneling. Extra cabin space, but LeTourneau accepts the penalty in order to retain the strength originally designed into the wing structure.

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HYDRAULIC star valve connects into the landing gear under the wing center section

from \$125,000 to \$270,000 or more, depending on the interior and engine selected. This cost is in addition to the price of the military B-58, but an option exists for the civilian aircraft, which would be \$12,000 to \$4,000. The conversion job will take a maximum of 60 days.

LeTourneau has two military B-58s available for conversion now. The company will take an order for a new one version or will sell one of its own aircraft, probably for about \$175,000, and start work on a new aircraft for its own use. Hubert E. Tunc, LeTourneau's civilian administrator, says the company is discussing conversion with several interested passengers and has now decided to offer the complete aircraft to the private aircraft market.

American Activity

LeTourneau launched its aviation activity in 1955 when the company started using Wien biplane for executive transports. Various aircraft have been used since then and LeTourneau has developed its own capabilities for maintaining and modifying them.

The first B-58 was received just after World War II, and LeTourneau repaired the aircraft for three years to restore its performance before disengaging the aircraft. The aircraft was then sold, but two other B-58s have been converted and are now in use by the company. Most of the work done that did the original job is still working at LeTourneau Air Center.

Through this period, the company has established an airframe overhaul facility, and does its own metal forming and painting. LeTourneau also has a radio shop and an upholstery shop, and the extensive B-58 com center will be disengaged. Lack of an aircraft shop makes maintenance work the only aspect of aircraft overhaul, maintenance and repair that is subcontracted to outside firms.

An engine overhaul that has been developed, and LeTourneau overhauled

the B-58s from the B-58s, as well as several smaller engines. Company has an engine test cell adjacent to its production shop. Both have been built on most generous aircraft overhaul contracts, and the award of a contract would mean an expansion program for the aircraft layout.

LeTourneau has been gradually moving into commercial aviation as a third base operator for the past year and a half. Now the company is thinking of setting up an aviation sales organization, although no final decision has been reached. Along with the transportation, accommodation and service units, a charter service is operated with Convair 340, Boeing Bonanza, Lockheed L-10 and Pratt Apache aircraft, and a Lockheed Lodestar will join the fleet later this year.

Another enterprise activity, the LeTourneau Technical Institute, is now raising out AME students and is starting a flight school.

PRIVATE LINES

Fest of the Four Bees L-188 Twin-Beech, featuring an enlarged baggage-holding conventional main entrance door behind the left wing, has been turned over to U.S. Army for evaluation at Ft. Rucker. Third unit is expected to be delivered early in March.

Withdrawal of the American Association of Airport Operators From the General Aviation Council, Bomber General Aviation Facilities Group was made official by AAAC's board in a letter to the council, stating that the airport operators group is the largest of the organizations with scheduled airline industry and military as well as general aviation, it should be in a position to deal directly and independently with FAA and other agencies.

Southeast Airline Co. completed its patch clamshell system and completed operation with opening of new office at Houston, Texas, and St. Louis, Mo. Distribution now is split in two regions. Kansas City office is headquartered for the Midwest region, and Memphis will be the new office at Lambert Field, St. Louis. New airport at Beaumont Municipal Airport is included in the southeast region with headquarters in Dallas.

Supplemental type certificate has been granted Fisher Corporation Co.'s modification of Convair 130A and 170B to 1930-lb. Lycoming 8-185 C engine and Thorold convertible propeller lift. Ford instrument kits of the conversion have been developed by the Southbury, Conn., company.

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Wisconsin Bank Buys, Operates Bell 47J



BELL 47 bought by First Wisconsin National Bank of Milwaukee is piloted by Robert Roth.

PT. Worth-Fins Wisconsin National Bank has bought a helicopter for executive transportation which is in the expected to speed services for western and correspondent banks served in the Midwest by the bank.

Bell Model 47 flew in early this month by First Wisconsin National Bank's pilot Robert A. Roth is the bank's first private plane since the aviation field, and Roth said it is the first commercial helicopter to be operated in Wisconsin.

Private planes for laying the Bell machine was to furnish efficient transportation for First Wisconsin executives on the business moved by the bank and to do other financial chores, such as insurance and estate.

Public transportation on riversides is another factor, and the helicopter may be used occasionally to make public services at helping the police control traffic jams.

Executive Transport

A bank spokesman said the Bell 47J will be primarily utilized for executive transport; first-class men may receive a check clearing service for the bank's five member banks and correspondent banks, but then plans for this service have not been made.

The helicopter he said, will be avail-

able to the First Wisconsin will be able to supply them quickly with the helicopter.

Most of the banks need to travel a 230-mile radius of Milwaukee, although some are more than 300 miles away. With these distances, the bank can use the added range of the 1959 model 47J it bought. First Wisconsin spokesman was the last to sign off on the latest model Bell had added as an option to extend range by about 40%. Loaded weight is 47.5 gal. New model also has rear blade.

When the bank was investigating the use of business aircraft, it decided the helicopter was the answer to its needs because its relatively limited service does not require the speed of a fixed-wing aircraft and because a lack of airports in certain areas makes the helicopter more practical. When the decision was made, the bank turned to Roth, who has flown for Chicago Helicopter Airways and Helicopter Airline, to set up an aviation department and fly the Bell machine.

First Wisconsin operations still have to use airports and heliports are available in the various communities served. Some extensive work will be needed to develop a heliport system in the area, but Roth said Milwaukee and state authorities are interested and "eager to help."

In Milwaukee, the helicopter will be used primarily as a liaison with night blisks from the bank. There is no heliport in the city but the bank is thinking of building one on the downtown site or possibly on the downtown area. If it does, a landing will be hard, and Roth expects to establish a Bell service station in anticipation of new helicopter operations that may come into the area. Meanwhile, Roth will do the running maintenance as the bank would and will lease it to Transamerica Field.

Pressurization Mod Developed for B-26

Pressurization modification for Douglas B-26 bombers has been developed by Lockheed Aircraft Service Inc. Features include enlarging and strengthening the fuselage, adding air vents close, picture windows, strengthened wing tanks and other interior modifications provide empty weight of 24,700 lb., total weight of 37,000 lb. and disposable load of 18,100 lb. With Pratt & Whitney R-2800 engines of 2,200 hp, pressurized B-26 will have a cruise speed of 375 mph and maximum range of 2,100 statute miles.

able for "emergency banking services," involving transportation of personnel, documents and, in some cases, cash. The bank, he added, never needs emergency in Wisconsin. Such services can be conducted with executive type.

At times, other banks directly or as

expected need for bills of a nation de-



PILOT Roth was hired by the bank to set up an aviation department and fly the 1959 model Bell 47J.

WHO'S WHERE

(Continued from page 23)

Honors and Elections

Dr. Alan Landis, a senior project engineer at the Air Research and Development Command's Wright Air Development Center, has been named a recipient of the Father S. Flanagan Award presented annually to young men in the federal service in recognition of outstanding achievement in engineering, mathematics, science, and literature.

Also named recipients of the Flanagan Award are Wilson A. Moore, an Air Force supervisory aerodynamicist at ARDC's Wright Air Development Center, and Douglas J. Wilson, head of the Underwater Defense Division of the U.S. Naval Defense Test Station, Frederik, Calif.

C. N. Brown, president of the Air Line Pilots Assn., has been appointed to the National Aerospace and Space Administration's Committee on Aircraft Planning Problems and the Long Range Planning Committee of the Radio Technical Commission for Aeronautics.

Changes

Dr. Robert E. Robinson, director of advanced space guidance Systems Corporation of America, Los Angeles, Calif.

Long Beach Division, Douglas Aircraft Company, Inc., Long Beach, Calif., has named the following assistant chief engineer: Lewis T. Lee for military transports, and John Ryan for mobile aircraft, missile and space vehicles.

Ralph E. Byrd, director of engineering Calidron and Tron, operating division, Convair Division of General Dynamics Corp., San Diego, Calif., William W. Farnsworth, M. S. Bailes as chief engineer; Doug Dornbeck, and Richard P. White as chief of flight test as assistant that organize the division.

Jerome David, director of engineering and Philip A. Herrem, chief engineer, Semicon Components Co., Santa Monica, Calif.

Henry E. Wigg, general manager, newly formed Avco Electronics Division, Avco Corp., Woburn, Mass., Arthur M. Corlett, managing director of the West Coast department of the Metcalf and Sibley Radio Division, Los Angeles.

Dr. George D. Knoll, director of research instruments, The Merck Co., Rahway, N.J.

K. D. Gagnon, chief engineer, Vought Vulu Co., Inc., East Aurora, N.Y.

W. H. Jaeger, corporate engineering and planning vice president of Aerostar Inc., North American Aviation Inc., East Grinstead, Calif.

Donald E. Ross, marketing manager, Aircraft Instrument Product Systems, Instrument Department, General Electric Co., West Lynn, Mass.

William C. Schaefer, staff advanced systems research engineer, California Division Lockheed Aircraft Corp., Burbank, Calif.

S. Paul Scheidtke, staff scientific professor, design, planning and conversion systems, Research and Development Division, The W. L. Marmon Corp.,



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MADAR ENGINEER to analyze ultimate loads and predict techniques and to develop new concepts involving hypersonic vehicles for advanced airborne and space systems. Design satellite rocket cells, microphones and detection circuitry. Analyze steerable refer systems to determine theoretical efficiency and performance limitations. Experience with transonic circuits or related test equipment is highly desirable.

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ENGINEERING PHYSICIST to assist in design and development of advanced solid state components. Must have extensive background in electronic fundamentals plus knowledge of solid state phenomena and materials. Must be capable of participating in logic development with minimum supervision.

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LETTERS

Pilot Responsibility

By E. T. Let me be honest for the last time. You are not bound by the law, but you are bound by the code of ethics.

"Folks like me can't get lost in the clouds." You took the words right out of my mouth. I heard more "I know that" than I did in clouds this morning.

EXAMINER TEST PILOT

Seattle, Wash.

I think R. Holt has a hell of a paper writing in regard to pilot responsibility when in fact he is completely responsible as the language and facts are in and external to his influence. In reference to the CAA check of Northwest Airlines pilots one thing must be clear. "Pilots who are performing 'relative difficult' and the other said tests being 'too difficult' etc. if the examiner sees fit, can easily bring one up to the point where they should be given the CAA test. I think Holt just doesn't see this clearly but no where as the check items do these phrases exist. Consequently, I would argue a responsible responsible pilot takes it upon himself to see if his examiner feels that he is performing difficult tests. If the examiner says "no" then it's up to him to demand a recheck. These "long," "shorting" and "relatively" may have many thousands of incidents known to pilots in numerous books.

Now, there are two - a pilot's ability as a primary factor and the examiner's judgment also at play here which is far too broad. I would say a minimum standard set by both examiner and CAA. Now the CAA and the examiner are not the same. CAA is more responsible for broader training in company check pilots to increase first proficiency. CAA will also inform specifically by the CAA that the Northwest Airlines' pilot check is not going to be well done. This is an argument as far as pilot proficiency is concerned.

So again, I would like to say and glad to making a point internally have about testing more responsible and respect for both hosts and examinees.

Capt. W. J. Sorenson
Northwest Airlines

I have just sent your very excellent column, "Responsible and Responsible" (AVW Feb. 16, 1951). That is one of the best columns I have ever read and I would like to thank you for it. It goes to the hearts of every other pilot in the country. Its sales are tremendous.

Congratulations.

B. J. Visciano
Aircraft Supply, Inc.
Washington, D. C.

Your editorial "Reynolds and Baggett, why?" (AVW Feb. 18, p. 70) about pilot fatalities and pay and Capt. Reissner's article in the same issue (p. 45) about the Electra crash at LeGarde, made me sit up again to the Feb. 9 issue. I was sitting for hours.

Address Book informs the application of its contents on the names record in the postmaster's editorial columns. Address letters to the Editor, *Aeronautics Week*, 1000 16th Street, N.W., Washington 6, D.C.

Please keep drivers under 500 words and give a proper identification. We will not publish anonymous letters, but names of authors will be withheld on request.

The Feb. 9 *Aerospace Week* had your editorial "The Cost of Pilot Errors" and Robert Sorenson's note concerning the error reported (p. 50). I will close the question.

You list the pilots, their attitudes, state of their proficiency, and then assess according to their proficiency. Also you listed the CAA and the examiner for inspection. Here you are left to make your own conclusions and especially not at all. Some of the things you say about pilots may be justified, but I don't buy all of it.

Pilots are not perfect, nor are examiners perfect, nor are inspectors which is also not perfect. This has nothing to do with fair play, nor does their moral shifts or their intelligence. It does however have something to do with the amount of training and practice that was so offered them.

It is not unusual to defend airline pilots like I. Believe they are corrected by their experience and in practice because of treatment, flight or simulated emergency flight training and personal desire. It is possible for pilots to start flying more than an hour conditioned run and never end up a 100 dog day.

This has been living from day one and also lead to take action, with regard to ground procedures in all phases of a pilot's career.

So it is important that pilots have frequent opportunity in practice and to check off all phases of flying not concentrated on certain flights. Sometimes I wonder if all airline pilots are not equally qualified to fly like this. The records are the same, 2000 where pilots have faithfully responded to management. Then there are the CAA accident reports with their conclusions of pilot error.

The comment (EW 18) regarding the CAA report above the sound created at Vinton is an example. I had almost written to *Aerospace Week* CAA or somebody about what I thought to be an undue statement in the report. I did not do so.

Investigation had already said the pilot's skill flight check records indicated that the pilot had a poor performance in holding altitude and performing instrument flight. However, this was interpreted by writers (including myself) as being a poor performance. I believe that the pilot's real difficulty is related mainly to reading his cockpit while performing with the aid of a flight scope.

Indeed a greater weight reader of this column by the pilot, with an otherwise good record, should have been able to do this with room to spare in spite of flight check.

My thought about this is that pilots can get into some things if they do not have beyond necessities to practice the over stresses. Of course the economies of size

size. Large transports without parked aircraft pilots can practice could have something to do with it.

Capt. Robison's article and beautiful essay on the P-51s brought undoubtedly pride in memory of our recent success of the Korean conflict. Also it raised the concern that "most crashes are the result of man's fault." Those racing contractions (AW Feb. 16, p. 17) speak for itself.

However, this item from Robert Reissner's column, seems to indicate no pilot can be faulted for his lack of skill and indicates that the engine was a "... expertly well sheeted H-1600" by a highly skilled pilot. True, it had slightly more than 40 hours on the block and standing for what? (See *New York Chamber of Commerce* page 10.)

Other organizations have discovered that a pilot's 100 hr. is an important requirement for the most control. This being half of a pilot's life should not be taken upon his ability to fly. The CAA has a 100 hr. limit on the P-51 and the pilot is on three years.

My opinion is the old management and PIA allows a pilot in the early stages of their formation in every field to progress to operate on such a "longshot" basis. In the case of the P-51, 100 hr. is not enough. The pilot getting the less 100 hr. should have been selected. Later on other pilots could get that experience flying with very little bad sheen required.

Also there is the question as we would like to have the best trained to do the best. Management could offer some solutions and comprehensive training.

Perhaps someone should think on a way for the government to schedule preventive and decisive ground tasks along with pilot training so that the public will feel it would be a thing upon long the necessity to operate a business of a profit.

Ronald R. Visciano
Washington, D. C.

While I am a rank amateur, I've been very close to planes and flying for many years working with ALPA with individual pilots with the Flight Safety Foundation with aircraft accident investigation in Far East, Australia, New Zealand etc. so I have seen that the average accident and a way to more than the average knowledge of what's going on.

In view of the current column on the Feb. 16 issue of *Aerospace Week*, I have from personal conversation with pilots that the good defensive pilot is just as concerned about the position of some pilots with two jobs as they are flying one commercial job. I have seen many cases where the best defensive pilot in have a bit visual approach, as you put it to the tail of spotting them as much as possible for the sea air.

In these one possibility of getting repeat of the accident editorials which I would like to see, I would like to see the people who are not "good" the defensive pilot but people who are concerned. Again for protection.

Howard S. Korn
Hawthorne Ind.

THE KING OF AIR FIGHTERS



Spinning erratically, the S. E. 5a fell from the sky, followed closely by a German Albatros. At 5,000 feet, the Hun turned out to watch the crash. Instead the S. E. 5a pulled out on another.

(Continued on page 11)



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